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## Additions to the orchid flora of Laos and taxonomic notes on orchids of the Indo-Burma region

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**ABSTRACT:** The following nine new additions to the orchid flora of Laos PDR are reported based on surveys in the country conducted during the period 2012–2017: *Bulbophyllum alcorni*, *B. meson*, *Coelogyne suaveolens*, *Cyrtosia nana*, *Dendrobium phuketense*, *Oberonia rhizoides*, *Phaius columnaris*, *Thelasis khasiana* and *Zeuxine longilabris*. The taxonomy of a further 15 orchid taxa (*Bulbophyllum guttatum*, *B. moniliforme*, *B. sarcophyllum*, *B. scabratum*, *B. seidenfadenii*, *B. tipula*, *Cleisostoma lecongkietii*, *Coelogyne ovalis*, *Dendrobium chapaense*, *D. crepidatum*, *D. wattii*, *Habenaria gibsonii* var. *foetida*, *H. malintana*, *Luisia zeylanica* and *Phalaenopsis pulcherrima*) native to Laos or adjacent countries is reviewed, resulting in the synonymisation of 20 names. In addition, new combinations are made for *Grosourdya vietnamica*, *Luisia sonii* and *Holcoglossum gaoligongense* to bring them in line with recent changes in the classification of the orchid family.

**KEY WORDS:** Conservation, Floristics, Indo-Burma Biodiversity Hotspot, New record, Orchidaceae, Taxonomy.

### INTRODUCTION

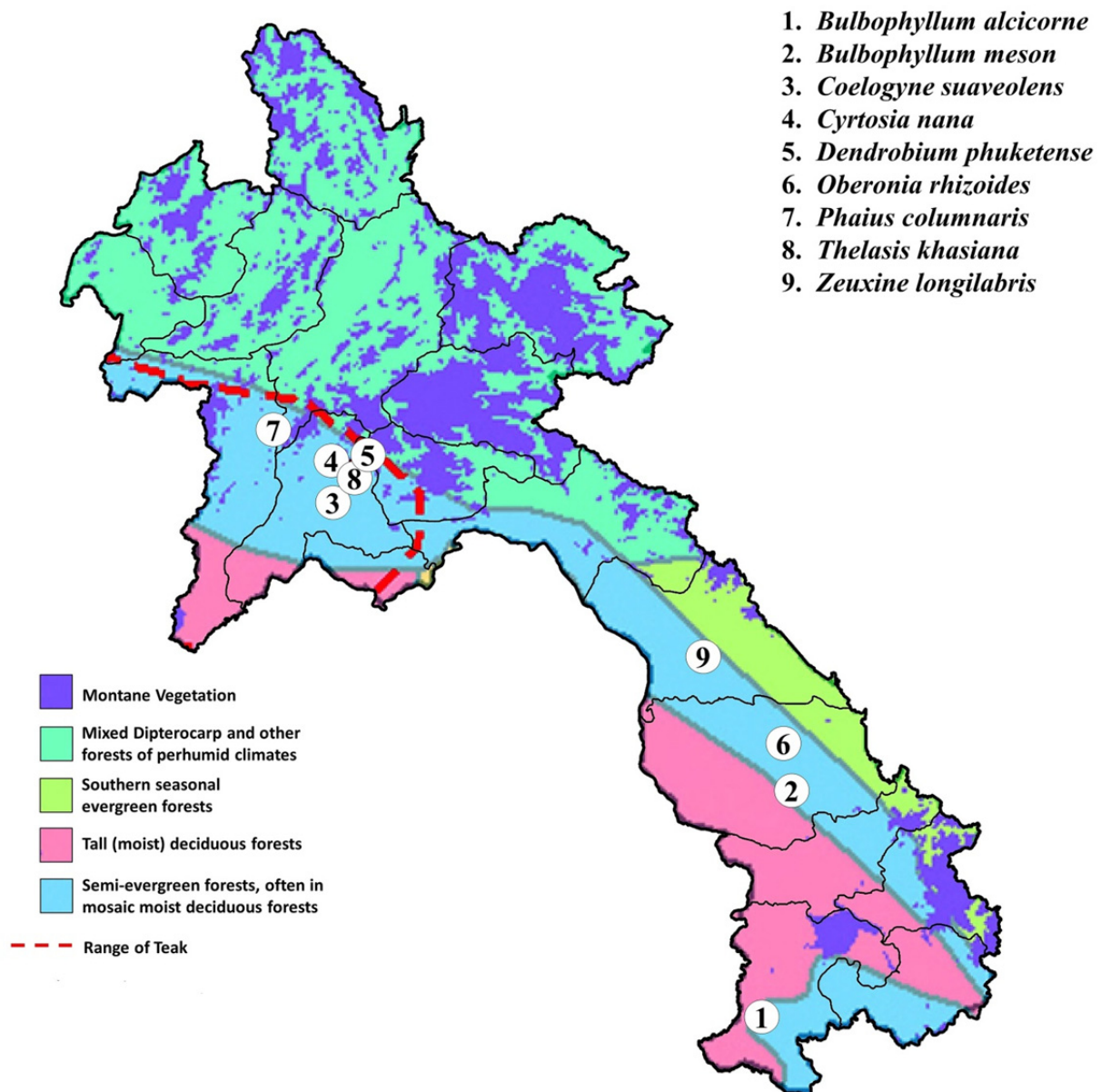
The Lao People's Democratic Republic (hereafter Laos) represents a floristically important component of the Indo-Burma Biodiversity Hotspot (IBBH) because it accounts for the single largest portion of the Indochinese limestone belt (Rundel 1999). However, it remains one of the least surveyed countries of the region (Newman *et al.* 2007, Schuiteman *et al.* 2008, Kumar *et al.* 2016). This situation is amply reflected by the state of taxonomic knowledge of the Orchidaceae, the most speciose flowering plant family of the IBBH (Tordoff *et al.* 2011; Li *et al.* in press): whilst Laos has a known orchid flora of 633 species, of which 12 are considered endemic, that of four of its five neighbours is considerably larger, with 874 species (of which 70 endemic) in South China (Hainan Island, southern parts of Yunnan, Guangxi and Guangdong provinces, plus Hong Kong and Macau Special Administrative Regions), 836 species (of which 76 endemic) in Myanmar, 1272 species (of which 147 endemic) in Thailand, and 1127 species (of which 222 endemic) in Vietnam; only understanding of Cambodia's orchid flora might be considered poorer, currently with 327 species, of which five are endemic (Schuiteman 2013, Kurzweil & Lwin 2014, Govaerts *et al.* 2017, Li *et al.* in press).

#### History of Orchid Surveys in Laos

Arthur Francis George Kerr (1933a) presented natural history notes on the flora of Phou Bia, a

mountain in Xaysomboun Province in central Laos, and in the same journal enumerated 40 orchids, including seven new species (Kerr 1933b). Later, Allen D. Kerr published two accounts of orchid collections in Laos, initially adding 88 species (Kerr 1969), followed by a further 29 (Kerr 1971). Seidenfaden (1966) listed 39 species based on his surveys in Laos in 1957–1958, and later published a more comprehensive account, listing 316 species (Seidenfaden 1972). In a more detailed treatise focused on orchid diversity throughout Indochina, Seidenfaden (1975a) published a list of 758 species known to occur in Cambodia, Laos and Vietnam, but this did not provide any information on species' ranges within the region. In an updated version, he enumerated around 800 species belonging to 140 genera (Seidenfaden 1992) and this time included information on the distribution of species in individual countries. Based on this information, it can be inferred that 335 species of orchids were known to occur in Laos at that time. Newman *et al.* (2007) added a further 145 species belonging to 19 genera, based on the findings of their own surveys plus a review of herbarium specimens collected within Laos itself as well as in adjacent areas and which might therefore be indicative of a species' occurrence inside the country. Schuiteman *et al.* (2008) based their list of 485 species and 108 genera purely on vouchered material collected within the country.

More recently, there has been a shift in botanical interest towards Laos, resulting in the discovery of both new species and new country records. Averyanov (2013)



**Map 1.** Map of Laos PDR showing the occurrence of the newly discovered orchid species reported here in relation to broadly defined forest types. Reproduced from Ashton (2015) with permission.

added 46 new records, followed by 50 more three years later (Averyanov *et al.* 2016a). Based on a survey of limestone vegetation in Vang Vieng District of Vientiane Province, Kumar *et al.* (2016) added a further nine new records for the country. Meanwhile, Groß *et al.* (2014), Gale *et al.* (2016) and Gale & Phaxaysombath (2017) each added a new species. Drawing on this relatively brief period of increasingly thorough exploratory work, a running total of 684 species belonging to 125 genera can now be confirmed in Laos (Averyanov 2013; Averyanov *et al.* 2014, 2016a, 2016b, 2016c, 2017; Govaerts *et al.* 2017; Kumar *et al.* 2016; Pedersen 2011a; Schuiteman &

Bonnet 2009, 2014; Schuiteman & de Vogel 2000; Schuiteman 2013; Svengsuksa & Lamxay 2005), with nomenclature brought in line with current phylogenetic understanding of the family (Chase *et al.* 2015).

However, given that sampling effort remains low for most of the country (Newman *et al.* 2007), both Schuiteman *et al.* (2008) and Kumar *et al.* (2016) have indicated that considerably greater orchid diversity can still be expected. Following recent ongoing surveys by the present authors in Attapeu, Champasak, Khammouane, Savannakhet, Vientiane, Xayaboury and Xekong Provinces, a further nine orchid species are here newly added to the flora of Laos, all of which were



found in semi-evergreen/moist deciduous forest, as defined by Ashton (2015; Map 1). In conducting a literature review pertinent to the flora of the IBBH, we came across a further 20 names belonging to the Orchidaceae which required synonymisation under 15 existing taxa. Additionally, three new combinations necessitated by recent changes to the classification of the family (Chase *et al.* 2015) are formally made here. Finally, lectotypes for three species are designated.

## TAXONOMIC TREATMENT

### New country records

**1. *Bulbophyllum alaicorne*** C.S.P. Parish & Rchb. f., Trans. Linn. Soc. London 30: 151 (1874); Seidenfaden (1979: 185, t. 132); Ridley (1907: 70); Holttum (1953: 459); Seidenfaden & Wood (1992: 497, t. 225). *Phyllorkis alaicornis* (C.S.P. Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891). Type: Myanmar, Moulmein, 1868, *E.C.Parish* 260 (Lectotype K!), designated by Clayton 2017: 64).

#### Fig. 1A

Creeping epiphyte. Rhizome 3.5–6.5 mm long in between pseudobulbs. Pseudobulbs small, slightly broader than the width of the rhizome, globose with longitudinal grooves, embedded in the rhizome, surrounded by fibrous remains of the sheath, bearing a solitary leaf. Leaf succulent, stout, obovate, 3.5–6.5 cm long, 0.7–1.6 cm wide, 4.0 mm thick, tapering at base, acute, with central longitudinal groove. Inflorescence racemose, 8.8–11.4 cm long, red-purple, erect, bearing 1 or 2 sterile bracts, rachis slightly thickened, strongly recurved, bearing 10–17 sub-densely arranged flowers. Flowers yellow-brown with red-purple stripes, 7.0–7.3 mm tall, 3.5–4.0 mm across; dorsal sepal oblong-elliptic, 4.5–5.0 mm long, 1.5–2.0 mm wide, subacute, entire, 5-veined; lateral sepals, obliquely obovate, 3.5–4.0 mm long, 1.5 mm wide, acute, pendulous, 3-veined; petals membranous, translucent, margins and apex red-purple, ovate, 2.0–2.2 mm long, 1.2–1.5 mm wide, acute, margins minutely erose, 1-veined; labellum yellow, folded to form a longitudinal groove in basal half, pendulous, entire, broadly elliptic, 2.5 mm long, 1.0 mm wide, minutely papillose; column short, 1.0–1.2 mm long, 0.7 mm wide, steldia broad, irregularly divided into three lobules, one pointing forwards, two pointing downwards; operculum connected to the column apex by a slender filament, broadening to form 2 locules, distinctly beaked and minutely dentate at apex, 0.6 mm long, 0.5 mm wide.

**Habitat.** Growing on lower limbs of scattered remnant trees in disturbed dipterocarp forest.

**Global Distribution.** Laos, Myanmar, Thailand and Peninsular Malaysia.

**Specimens examined.** LAOS. Champasak Province, Soukhouma District, 107 m, 18 May 2017, *Gale, Fischer, Kumar,*

*Bouamanivong, Phaxaysombath & Lorphengsy* HNL-KFBG 1004 (HNL). **MYANMAR.** Moulmein, 1868, *E.C.Parish* 260 (K).

**2. *Bulbophyllum meson*** J.J. Verm., Schuit. & de Vogel, Phytotaxa 166: 111 (2014). *Trias intermedia* Seidenf. & Smitinand, Orch. Thail. (Prelim. List): 809 (1965). Type: Thailand, Chanthaburi, 21 Dec. 1924, *A.F.G.Kerr* 0205 (K!).

#### Fig. 1B

Small, creeping epiphyte. Rhizome up to 1.5 cm long in between pseudobulbs. Pseudobulbs clustered, globose, dorsoventrally compressed, up to 0.5 cm tall and 1.2 cm in diameter, smooth, shiny and covered with translucent silvery sheath when young, becoming wrinkled with age, green to brownish-purple. Leaf solitary, rigid, fleshy, ovate, 1.3–1.8 cm long, 1.0–1.2 cm wide, obtuse, dark green above, pale green underneath with dark green mid-vein. Inflorescence emerging from base of pseudobulb, up to 1.5 cm long, bearing 1 flower. Flower pale yellow flushed pink with purple lines on sepal and petals, up to 1.0 cm across; sepals equal, ovate, 6.0 mm long, 4.0 mm wide, apiculate; petals minute, 1.5 mm long, 1.0 mm wide; labellum yellow, flushed pink near margin, slightly grooved in the basal half, pendulous, entire, elliptic, side lobes absent, 1.5–2.0 mm long, 0.5 mm wide; column 1.5 mm long, 1.5 mm wide; operculum with two elongated teeth facing the labellum; pollinia 4 in 2 pairs.

**Habitat.** Growing on rough, cracked bark of trunk and lower branches of *Dipterocarpus* sp. in open, semi-deciduous forest.

**Global Distribution.** Laos and Thailand.

**Specimens examined.** LAOS. Savannakhet Province, Phin District, 179 m, 9 Dec. 2016, *Gale, Kumar, Phaxaysombath, Phothisath & Phoummathep* HNL-KFBG 0886 (HNL). **THAILAND.** Chanthaburi, 21 Dec. 1924, *A.F.G.Kerr* 0205 (K).

**3. *Coelogyne suaveolens*** (Lindl.) Hook.f., Fl. Brit. India 5: 832 (1890). *Pholidota suaveolens* Lindl., Gard. Chron. 1856: 312 (1856). *Pleione suaveolens* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 680 (1891). Type: India, 19 May 1856, *Bishop Winchester s.n.* (K!).

#### Fig. 1C

Robust, scrambling epiphyte with woody, creeping rhizome covered in brown, papery sheaths and bearing many straggly roots. Pseudobulbs widely spaced, conical-ovoid, slightly curved, becoming angular when desiccated, 5.5–11.0 cm tall, 1.5–3.8 cm wide near base, bearing brown fibres of scaly sheaths at base and two leaves at apex. Leaves obovate, 15.5–29.2 cm long, 4.8–6.5 cm wide, conduplicate and tapering at base into a slender, rigid petiole-like stalk 4.0–5.2 cm long, acute, many veined, margin undulate, glossy green. Inflorescence erect, arching slightly, arising from pseudobulb apex between young leaves, 10.5–27.2 cm long, rachis zig-zagged, bearing 6–16 flowers. Flowers laxly arranged, 2.0 cm across, white; sepals and petals



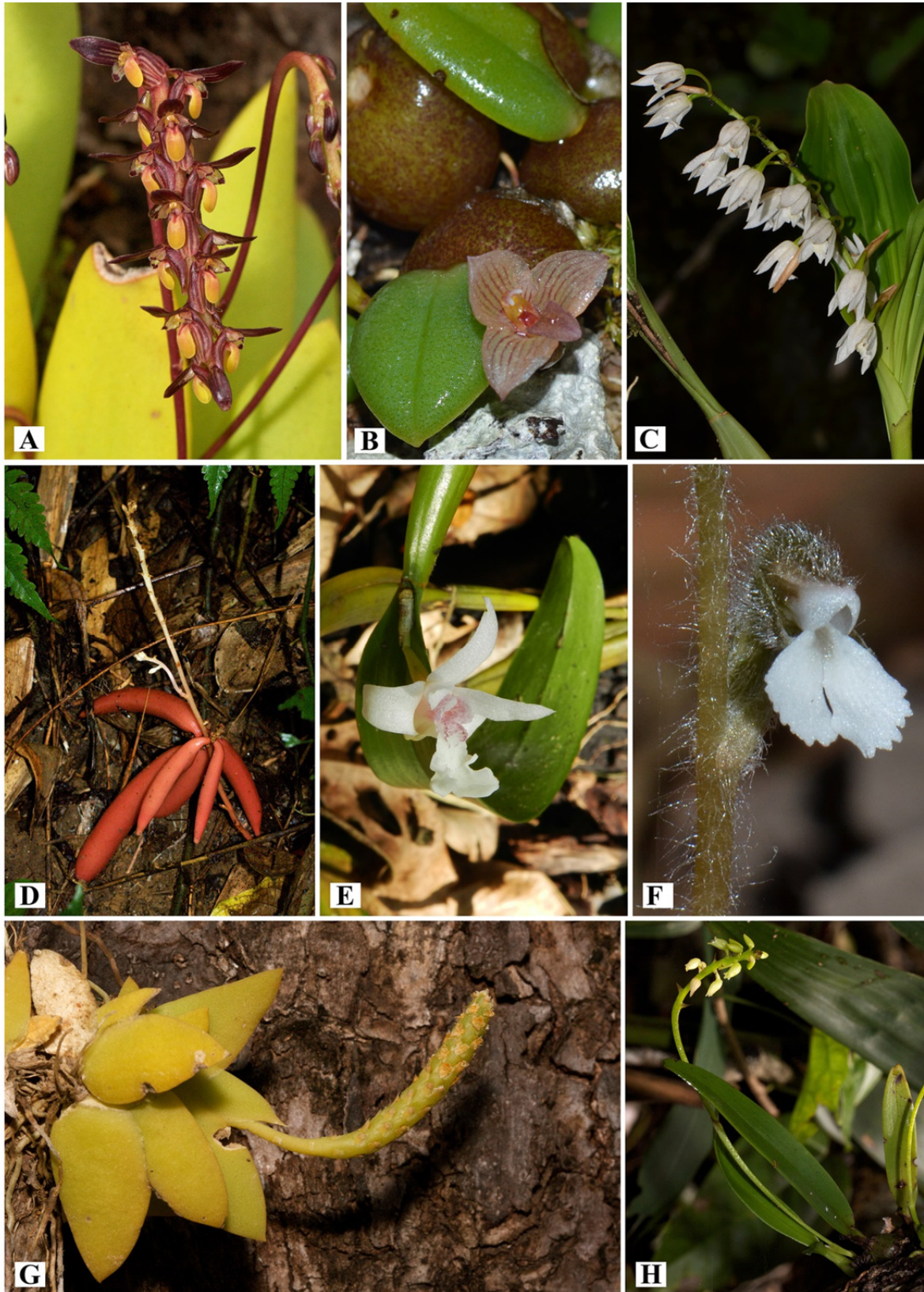


Fig. 1. Newly reported orchids from Laos. A. *Bulbophyllum alcicorne*; B. *Bulbophyllum meson*; C. *Coelogyne suaveolens*; D. *Cyrtosia nana*; E. *Dendrobium phuketense*; F. *Zeuxine longilabris*; G. *Oberonia rhizoides*; H. *Thelasis khasiana*. Photo credits: A, C, D, G, H by Stephan W. Gale; B by Thatsaphone Phaxaysombath; E, F by Pankaj Kumar.



oblong-elliptic, 1.2–1.8 cm long, 3.5–4.5 mm wide, acute; labellum obovate-flabellate, 1.2–1.5 cm long, 5.0–6.0 mm wide, 3-lobed near the middle, side lobes rounded, mid-lobe broadly elliptic and bearing a pale yellow callus of several parallel, undulating crests, acute; column 8.0 mm long.

**Habitat.** Growing on exposed limestone ridges and mossy tree trunks in open forest.

**Global Distribution.** China, India, Laos, Myanmar and Thailand.

**Specimens examined.** INDIA. 19 May 1856, *Bishop Winchester s.n.* (K). LAOS. Vientiane Province, Vang Vieng District, 356 m, 26 April 2012, *Gale, Kumar, Santainsy & Phunthavong HNL-KFBG 0044* (HNL); Vang Vieng District, 462 m, 30 April 2012, *Fischer, Gale, Kumar, Bouamanivong, Santainsy & Phunthavong HNL-KFBG 0216* (HNL); Vang Vieng District, 462 m, 30 April 2012, *Fischer, Gale, Kumar, Bouamanivong, Santainsy & Phunthavong HNL-KFBG 0259* (HNL).

**4. *Cyrtosia nana*** (Rolfe ex Downie) Garay, Bot. Mus. Leaf. 30: 233 (1986); Chen *et al.* (2009: 169). *Galeola nana* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925: 409 (1925); Seidenfaden (1978: 132, t. 81). Type: Thailand, Doi Suthep, 900 m, 4 Aug. 1912, *A.F.G.Kerr 313* (K!).

#### Fig. 1D

Leafless, mycoheterotrophic terrestrial herb. Tubers rhizomatous, horizontally placed, 2.4–10.0 cm long, 4.5–10.2 mm wide, branched, covered with white translucent sterile bracts. Inflorescence erect, 15.5–20.0 cm long, 2.5–3.5 mm in diameter, terete, branched, reddish-white, pubescent, bearing 10–20 clustered flowers towards the apex; floral bracts small, triangular, 3.5–4.0 mm long, acuminate, translucent, brown-red. Flowers large, opening widely, 4 cm across, bright yellow, outer surfaces scaberulous; pedicel and ovary terete, 13.5–14.0 mm long, 1.8–2.0 mm in diameter, pale white, minutely pubescent; sepals ovate, ca. 14.5–16.0 mm long, 4.2–5.5 mm wide, the lateral sepals larger than the dorsal one, acute, inner surfaces smooth; petals elongate-elliptic, 14.8–16.2 mm long, 3.0–3.5 mm wide, acute, scaberulous also on inner surfaces; labellum cupulate, 15.5–16.5 mm long, 9.8–15.4 mm wide, bearing a pair of triangular keels near the middle, bright yellow with tiny red spots near the base and central brown-red band; column cylindric, 8.5 mm long, 1.2–1.4 mm in diameter towards base, broadening to 2.0 mm in diameter towards apex, surface minutely pubescent, foot absent. Capsules fusiform, 4.8–9.4 cm long, 1.3–1.8 cm in diameter, fleshy, non-dehiscent, bright red and shiny when mature.

**Habitat.** Growing near rotting tree stump in deep shade in evergreen hill forest on limestone. Avian seed dispersal has recently been reported for this genus in Japan (Suetsugu *et al.* 2015).

**Global Distribution.** China, India, Laos, Thailand and Vietnam.

**Specimens examined.** LAOS. Vientiane Province, Vang

Vieng District, 639 m, 28 April 2012, *Fischer & Bouamanivong HNL-KFBG 0154* (HNL); Vang Vieng District, 548 m, 7 July 2015, *Gale, Kumar, Lasahak, Phaxaysombath & Phunthavong HNL-KFBG 0455* (HNL). THAILAND. Doi Suthep, 900 m, 4 Aug. 1912, *A.F.G.Kerr 313* (K).

**5. *Dendrobium phuketense*** Schuit. & Peter B. Adams, Muelleria 29: 67 (2011). *Flickingeria insularis* Seidenf., Dansk Bot. Ark. 34: 31, t. 9 (1980). Type: Thailand, Koh Chong Lat, Phuket Bay, *GT 6481* (C!).

#### Fig. 1E

Clumped epiphyte. Rhizome woody, creeping, 5–6-noded between stems, bearing many vermiform roots 1.5–10.0 cm long. Stems erect or semi-erect, 10.5–13.5 cm long, branched, basal-most internode swollen, conical, 4.5–6.5 mm long, 4.5–5.0 mm wide at the base, narrowing to 2.5–2.8 mm wide at the apex, successive internodes broadening with the apical one bearing a pseudobulb. Pseudobulbs oblong-lanceolate, longitudinally compressed, 4.3–5.6 cm long, 0.5–1.1 cm wide, bearing a solitary leaf at apex. Leaf lanceolate, 8.5–14.2 cm long, 1.9–2.4 mm wide, acute, adaxial surface dark green, abaxial surface pale green. Inflorescence arising from apex of pseudobulb at base of leaf near adaxial surface, 1-flowered. Flower white, 1.5–1.8 cm across, opening widely; dorsal sepal elliptic-oblong, 12.5 mm long, 3.8 mm wide, acute; lateral sepals sub-triangular, slightly oblique, 13.0 mm long, 5.8 mm wide, acute; petals linear-lanceolate, 12.5 mm long, 2.7 mm wide, acute; labellum 3-lobed, arising from the base of the foot of the column, 11.0–12.5 mm long, 11.0–11.3 mm wide towards the front, 5.5–6.0 mm towards the base, divided into epichile and hypochile, bearing 3 central parallel lamellae of which 2 arise at the base of the hypochile and end midway along the epichile and the third of which arises in between the other 2 just above the side lobes and ends beyond the other 2 towards the apex of the epichile; side lobes of hypochile obliquely ovate, 6.0–7.5 mm long, 1.2–1.5 mm wide, acute; epichile oblong-elliptic, 2.0–2.5 mm long, 3.0–3.2 mm wide near the base, broadening to 10.0–10.2 mm wide at the middle, lateral margins undulate, apex 2-lobed and with a small apiculate tip in the middle.

**Habitat.** In sparse primary forest on limestone karst dominated by *Euphorbia antiquorum*.

**Global Distribution.** Laos and Thailand.

**Specimens examined.** LAOS. Vientiane Province, Vang Vieng District, 448 m, 30 April 2012, *Fischer, Gale, Kumar, Bouamanivong, Santainsy & Phunthavong HNL-KFBG 0208* (HNL). THAILAND. Koh Chong Lat, Phuket Bay, *GT 6481* (C).

**6. *Oberonia rhizoides*** Aver., Turczaninowia 16(1): 133 (2013). Type: Vietnam, Dien Bien Province, Tua Chua District, Sin Chai Municipality, 14 Dec. 2010, *Averyanov et al., CPC 982a/15* (LE!).

#### Fig. 1G



Compact epiphyte with terete, creeping rhizome 5.0–6.3 cm long and 0.5–1.2 mm in diameter. Leaves imbricate, flattened, triangular-ovate, 0.7–2.1 cm long, 0.4–1.2 cm wide, fleshy, acute. Inflorescence arising from leaf axil, arching, 2.2–3.5 cm long, 1.5 mm in diameter near base, broadening to 3.5 mm diameter along the rachis; floral bracts scale-like, triangular, 0.5–0.7 mm long, 0.5–0.7 mm wide. Flowers minute, set into the rachis, 2.0–2.5 mm tall, 1.5 mm wide, orange; dorsal sepal triangular-ovate, 0.5–0.7 mm long, 0.4–0.5 mm wide, acute; lateral sepals obliquely ovate, 0.4–0.6 mm long, 0.5–0.6 mm wide, acute; petals linear, 0.5–0.6 mm long, 0.1–0.2 mm wide, acute; labellum protruding from rachis surface, ovate, 0.7–1.1 mm long, ca. 0.6–1.0 mm wide, concave at base, obscurely 3-lobed above the middle, the mid-lobe margins minutely erose and the apex shallowly notched; column short, 0.2–0.3 mm long, 0.2–0.3 mm in diameter.

**Habitat.** Epiphyte in sparse, dry evergreen forest.

**Global Distribution.** Laos and Vietnam.

**Specimens examined.** LAOS. Savannakhet Province, Phin District, 199 m, 7 Dec. 2016, Gale, Kumar, Phaxaysombath, Phothisath & Phoummathep HNL-KFBG 0871 (HNL). VIETNAM. Dien Bien Province, Tua Chua District, Sin Chai Municipality, 14 Dec. 2010, Averyanov *et al.*, CPC 982a/15 (LE).

**7. *Phaius columnaris*** C.Z.Tang & S.J.Cheng, Bull. Bot. Res., Harbin 5(2): 141 (1985); Chen *et al.* (2009: 291). *Paraphaius columnaris* (C.Z.Tang & S.J.Cheng) J.W.Zhai, Z.J.Liu & F.W.Xing, Molec. Phylogen. Evol. 77: 221 (2014). Type: China, Guangdong, Yinde, Xiniou, 230 m, 2 April 1981, S.J. Cheng 811249 (IBSC).

*Phaius guizhouensis* G.Z.Li, J. Wuhan Bot. Res. 8: 142 (1990). Type: China, Guizhou, Wang Mo, 180 m, 25 June 1988, G.Z.Li 12313 (IBG).

Stout terrestrial herb 1.0–1.5 m tall. Pseudobulbs cylindric, 15.0–25.0 cm long, 2.5–5.0 cm in diameter, dark green, strongly ribbed, unbranched. Leaves up to 7, elliptic, plicate, 60.0–80.0 cm long, 10.0–15.0 cm wide, acuminate. Inflorescence arising from near the base of the pseudobulb, 30.0 cm long, not exceeding the height of the leaves, terete, bearing up to 12 flowers clustered towards the apex. Flowers not opening widely, 4.0–5.5 cm across, white with orange-red markings on the labellum; pedicel and ovary clavate, up to 2.0–3.5 cm long, 1.0 cm in diameter, sparsely covered with brown hairs; sepals similar, oblong-obovate, 4.0–5.0 cm long, 1.0–2.0 cm wide, acute; petals oblong, 4.2–4.8 cm long, 1.3–2.0 cm wide, acute; labellum suborbicular, 4.0–5.0 cm long, 4.0–4.5 cm wide, with 3 ridges running from the base almost to the apex, inconspicuously 3-lobed, spurred at base; lateral lobes suborbicular, 4.0 cm long, 1.5 cm wide, apex rounded, margins undulate; mid-lobe ovate, 4.5–5.0 cm long, 2.0 cm wide, apex obtuse, margins crispate; spur corniculate, 5.5–7.0 mm long, 2.5–3.0 mm in diameter, apex concave, yellow-green

with white stripes. Column 2.0–2.5 cm long, 0.5–0.8 cm in diameter, ventral surface pubescent, white with orange stripes on ventral surface.

**Habitat.** Growing among boulders on ridge in evergreen hill forest on limestone karst.

**Global Distribution.** China and Laos.

**Specimens examined.** LAOS. Vientiane Province, Vang Vieng District, 279 m, 26 April 2012, Gale, Kumar, Santainsy & Phunthavong HNL-KFBG 0009 (HNL); Xayaboury Province, 1045 m, 28 June 2016, Gale, Kumar, Phothisath & Sysouphanthong HNL-KFBG 0660 (HNL).

**8. *Thelasis khasiana*** Hook.f., Fl. Brit. India 6: 87 (1890); Pearce & Cribb (2002: 399). *Thelasis pygmaea* var. *khasiana* (Hook.f.) Schltr., Mém. Herb. Boissier 8 (21): 71 (1900). Type: India, Khasia Mts, Lobb s.n. (K!).

#### Fig. 1H

Small epiphytic or lithophytic herb. Pseudobulbs clustered, ovoid, slightly compressed, 1.3–2.0 cm tall, 0.8–1.5 cm in diameter, bearing one long leathery leaf and rarely a second shorter one. Leaf oblanceolate, 4.5–11.2 cm long, 1.5 cm wide, 2-lobed at apex, tapering at base, the shorter leaf (if present) 1.0–2.4 cm long, 0.8 cm wide. Inflorescence arising from the base of the pseudobulb, erect, sometimes arching upwards if plants growing on vertical surface, 4.0–13.8 cm long, terete, bearing 8–14 laxly arranged flowers towards the apex; floral bracts ovate-lanceolate, 2.5 mm long. Flowers greenish-white, turning yellow-green with age, not opening widely; dorsal sepal ovate-lanceolate, 3.4–3.5 mm long, 1.5–1.6 mm wide, acute; lateral sepals broadly ovate-lanceolate, 3.5–3.7 mm long, 2.4–2.5 mm wide, sub-acute; petals lanceolate, 3.2–3.4 mm long, 1.2–1.3 mm wide, acute; lip ovate, 3.5–3.8 mm long, 2.3–2.4 mm wide, acute, 3-veined.

**Habitat.** Growing in the crown of large trees in evergreen forest on limestone.

**Global Distribution.** China, India, Laos, Thailand and Vietnam.

**Specimens examined.** INDIA. Khasia Mts, 18 Sept. 1850, Hooker & Thomson s.n. (K000891232) (K); 26 Sept. 1850, Khasia Mts, Hooker & Thomson 1835 (K000891233) (K); Khasia Mts, 22 July 1850, Hooker & Thomson s.n. (K000891234) (K); Khasia Mts, 11 July 1850, Hooker & Thomson 1642 (K000891235) (K). LAOS. Vientiane Province, Vang Vieng District, 339 m, 26 April 2012, Gale, Kumar, Santainsy & Phunthavong HNL-KFBG 0026 (HNL).

**9. *Zeuxine longilabris* (Lindl.) Trimen, Syst. Cat. Fl. Pl. Ceylon: 90 (1885); Kumar & Manilal (2004: 231). *Monochilus longilabris* Lindl., Gen. Sp. Orchid. Pl.: 487 (1840). *Haplochilus longilabris* (Lindl.) D.Dietr., Syn. Pl. 5: 173 (1852). Type: Sri Lanka, near Julio Mts, Macrae s.n. (K!).**

#### Fig. 1F

Terrestrial herb up to 30 cm tall. Rhizome creeping, 3.5–4.7 cm long, 0.4–0.8 mm in diameter, fleshy, contracted at the nodes, green, bearing several stout





roots. Stem ascending, bearing 4–5 scattered leaves. Leaves ovate, 1.5–3.0 cm long, 1.0–1.5 cm wide, sheathing the stem at base, acute, coriaceous, green, occasionally with red-brown mid-vein. Inflorescence erect, terminal, terete, 8.7–15.0 cm long, 1.5–2.5 mm in diameter, pubescent, bearing 10–12 flowers towards the apex; floral bracts longer than the ovary, ovate, 8.0–10.0 mm long, 2.0–3.0 mm wide, acuminate. Flowers not opening widely, pubescent, greenish-brown with a white labellum; ovary and pedicel 0.8–1.0 cm long, pubescent; dorsal sepal ovate, 5.2–5.5 mm long, 3.5–4.0 mm wide, acute; lateral sepal obliquely oblong, 4.0–5.0 mm long, 2.0–3.0 mm wide, acute; petals spatulate, 4.0–5.0 mm long, 1.7–2.5 mm wide, obtuse; labellum white, distinctly divided into hypochile and epichile, 12.5–13.5 mm long, 2.0–3.0 mm wide at the hypochile, saccate, broadening to 7.0–8.0 mm wide at the epichile, epichile 2-lobed; lobes diverging, lateral margins entire, slightly undulate and lacerate towards the apex. Column stout, 1.0–1.2 mm long, 1.0 mm in diameter.

**Habitat.** Growing in leaf litter among undergrowth in disturbed dry forest.

**Global Distribution.** Cambodia, India, Laos, Myanmar, Nepal and Sri Lanka. Previously reported from Thailand (Seidenfaden 1978: 91, Fig. 57a–b), but the material seen in that study has since been referred to *Z. affinis* (Lindl.) Benth. ex Hook.f. *s.l.* (Seidenfaden & Pedersen 2003; Pedersen 2011b).

**Specimens examined.** LAOS. Khammouane Province, Mahaxay District, 135 m, 24 Oct. 2014, *Gale, Kumar, Fischer, Bouamanivong, Phothisath & Phoumathap* HNL-KFBG 0370 (HNL). SRI LANKA. Near Julio Mts, *Macrae s.n.* (K000895716) (K); *J.D.Hooker* 332 (K000985716) (K); *J.G.Champion s.n.* (K000895715) (K); *J.G.Champion s.n.* (K000985716) (K); 1829, *J.Macrae* 4 (K000985717) (K).

#### New synonyms, lectotypifications and taxonomic notes

**1. *Bulbophyllum guttulatatum*** (Hook.f.) N.P.Balakr., J. Bombay Nat. Hist. Soc. 67: 66 (1970); Seidenfaden (1973: 176, t. 89; 1992: 291, t. 194); Chen *et al.* (2009: 425); Misra (2004: 474); Lucksom (2007: 708, t. 445). *Phyllorkis guttulata* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891). *Cirrhopetalum guttulatatum* Hook.f., Fl. Brit. India 5: 776 (1896); King & Pantling (1898: 94, t. 131). Type: Nepal, *Nathaniel Wallich s.n.* (BM000516909) (lectotype BM! selected here).

*Bulbophyllum chymangensis* D.Verma, Lavania & Sushil K.Singh, Phytotaxa 195: 94 (2015). **Syn. nov.** Type: India, Meghalaya, West Jaintia Hills District, Chymang, 1353 m, 8 Oct. 2013, *D. Verma* 53 (holotype ASSAM; isotype LWU).

**Taxonomic notes.** Hooker (1896) while describing *Cirrhopetalum guttulatatum* (which was later transferred to *Bulbophyllum* by Balakrishnan (1970) as *B. guttulatatum*) studied two specimens, one from Nepal (*Nathaniel Wallich s.n.*, BM000516909) and other from Sikkim (*Hooker* 32, K-LINDL.). Of these two, only former is available online and represents good

morphological variation due to presence of more than one plant on the sheet, hence we select it as a lectotype for *C. guttulatatum*.

*Bulbophyllum chymangensis* was differentiated from *B. guttulatatum* on the basis of its shorter inflorescence, fewer but larger flowers and the hairy margin of its labellum (Verma *et al.* 2015). Hooker (1890b) states the scape of *B. guttulatatum* to be 6–10 inches (15–25 cm) long and equal to or exceeding the leaf, and the type specimen bears seven leaves with wide morphological variation. Seidenfaden (1992) provided a sketch from the type showing only four flowers in the inflorescence, whereas the illustration given by King & Pantling (1898) shows nine. Misra (2004), on the other hand, noted the length of the inflorescence in plants from central India to be 6–7 cm long. Most of these characters used for distinguishing the new species are therefore very variable and entirely overlapping with the morphology of *B. guttulatatum*. Moreover, the distribution of *B. chymangensis* lies within the much wider distribution range of *B. guttulatatum* (Govaerts *et al.* 2017).

Given these observations, as well as the identical morphology of key species-level characters such as stelia dimensions and orientation (filiform and projecting forward in both cases) and column wing outline (triangular in both cases), *B. chymangensis* is hereby synonymised under *B. guttulatatum*.

**Global Distribution.** Bhutan, China, India, Laos, Myanmar, Nepal, Thailand and Vietnam.

**Specimens examined.** CHINA. Tibet, Motou, Jin *et al.* STET2568 (PE). LAOS. Xayaboury Province, Nahai Village, Pha Xang Mts, 773 m, 28 June 2016, *Gale, Kumar, Phothisath & Sysouphanthong* HNL-KFBG 0645 (HNL).

**2. *Bulbophyllum moniliforme*** C.S.P.Parish & Rehb.f., Trans. Linn. Soc. London 30: 151 (1874); Seidenfaden (1979: 50, t. 24); Schuitman *et al.* (2008: 269). *Phyllorkis moniliformis* (C.S.P.Parish & Rehb.f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891). Type: Myanmar, *E.C.Parish* 196 (lectotype K!, designated by Clayton 2017: 67).

#### Fig. 2A

*Bulbophyllum subtenellum* Seidenf., Dansk Bot. Ark. 33: 46, t. 21 (1979); Averyanov (2016b: 326). **Syn. nov.** Type: Thailand, Bueng Kan, Nonkhai, 120 m, 15 Nov. 1966, *TS [T.Smitinand] s.n.* (holotype C!).

*Bulbophyllum paramjithii* Agrawala, M.U.Sharief & B.K.Singh, Phytotaxa 72 (2016). **Syn. nov.** Type: India, Sikkim, East District, near Bhusuk, 1550 m, 26 March 2015, *Sharief & Singh* 37938 (holotype BSHC).

*Trias pusilla* J.Joseph & H.Deka, J. Indian Bot. Soc. 51: 378 (1973). *Jejosephia pusilla* (J.Joseph & H.Deka) A.N.Rao & Mani, J. Econ. Taxon. Bot. 7: 217 (1985). *Bulbophyllum jejosephii* J.J.Verm., Schuit. & de Vogel, Phytotaxa 166: 106 (2014). **Syn. nov.** Type: India, Meghalaya, Khasi & Jaintia Hills, Mawphland, Lawloingdoh, 8 Sept. 1970, *Hareshwar Deka* 37255A (holotype CAL).

**Taxonomic notes.** Seidenfaden (1979) differentiated *Bulbophyllum subtenellum* from *B. moniliforme* on the basis of its smaller flowers with broader, 3-veined





Fig. 2. Orchids of the Indo-Burma Biodiversity Hotspot for which taxonomic amendments are made. **A.** *Bulbophyllum moniliforme*; **B.** *Bulbophyllum scabratum*; **C.** *Habenaria malintana*; **D.** *Coelogyne ovalis*; **E.** *Dendrobium crepidatum*, pink colour form; **F.** *Dendrobium crepidatum*, white colour form. Photo credits: **A–F** by Pankaj Kumar.



lateral sepals and truncate lip. When studying *B. moniliforme*, Seidenfaden (1979) also studied a specimen from Jarain, Meghalaya State, India (*Deori* 51751), which he described as bearing slightly oblique pseudobulbs and longer leaves but which he nevertheless maintained under *B. moniliforme*. According to Averyanov *et al.* (2016b), the only significant difference between *B. moniliforme* and *B. subtenellum* is the presence of three veins in the lateral sepal in the former versus four or five in the latter.

Agrawala *et al.* (2016) differentiated *B. paramjitii* from *B. subtenellum* on the basis that its leaf is present during the flowering period (although in their own illustration some bulbs have a leaf while others do not) and because its labellum is different in shape. Despite this, their illustration of the flower matches the floral characters of both *B. moniliforme* and *B. subtenellum* in all respects, as well as the description of the specimen from Meghalaya (*Deori* 51751) studied by Seidenfaden (1979).

Joseph & Deka (1973) placed their new species in the genus *Trias*, but Rao & Mani (1985) later transferred it to *Jejosephia*, a new genus they established especially to accommodate it. That genus is now regarded as a synonym of *Bulbophyllum*, and so its sole member is accordingly accepted as *Bulbophyllum jejosephii* (Vermeulen *et al.* 2014). Within *Bulbophyllum*, it is readily assigned to Section *Minutissima* Pfitz. on the basis of its minute pseudobulbs that give rise to a single leaf and a 1-flowered inflorescence, its tubular floral bract, free sepals, undivided labellum that lacks a cavity on the adaxial surface, and its column foot that is not swollen distally (Pridgeon *et al.* 2014). Recently, Rao (2017) reduced *B. paramjithii* to the synonymy of *B. jejosephii*.

The distribution of each of *B. subtenellum*, *B. paramjithii* and *B. jejosephii* falls within the wider distribution range of *B. moniliforme* (Govaerts *et al.* 2017). Variation in the number of veins in the sepals from three to five gives rise to overlapping character states, as is evident from figure 4E in Averyanov *et al.* (2016b), which shows lateral sepals with both three and four veins in a single flower of *B. subtenellum*. In the absence of any decisive morphological differences, we conclude that *B. subtenellum*, *B. paramjithii* and *B. jejosephii* cannot be maintained as distinct from *B. moniliforme*.

**Global Distribution.** Cambodia, India, Laos, Myanmar, Nepal, Thailand and Vietnam.

**Specimens examined.** MYANMAR. *E.C. Parish* 96 (*K000829176*) (K). THAILAND. Bueng Kan, Nonkhai, 120 m, 15 Nov. 1966, *TS [T.Smitinand] s.n.* (C).

**3. *Bulbophyllum sarcophyloides*** Garay, Hamer & Siegerist, *Nordic J. Bot.* 14: 620 (1994); Pearce & Cribb (2002: 475). *Cirrhopetalum sarcophyllum* var. *minor*

King & Pantl., *Ann. Roy. Bot. Gard. (Calcutta)* 8: 91 (1898). Type: India, Sikkim, Sivoke, 1000 feet, 3 June 1891, *Pantling No. 95A (K000829948)* (holotype K!).

**Taxonomic notes.** King & Pantling (1898) described *Cirrhopetalum sarcophyllum* and *C. sarcophyllum* var. *minor* from Sikkim, mentioning the specimen *Pantling No. 95* with respect to the former but omitting any specimen citation for the latter.

Seidenfaden (1973a) included *C. sarcophyllum* var. *minor* under the synonymy of *C. sarcophyllum*, citing three specimens, all putatively from Sikkim (Rishap, Sivoke and Naru Valley), although on one the location is clearly written as “Sivoke, Independent Bootan (Bhutan)”. He also mentioned that the herbarium specimens he had seen were in bad condition. Garay *et al.* (1994) treated *Cirrhopetalum* at generic rank and in doing so transferred *C. sarcophyllum* and *C. sarcophyllum* var. *minor* to *Bulbophyllum* as *B. sarcophyllum* and *B. sarcophyloides*, respectively, without assigning a lectotype for either.

Chowdhery (1998) documented both entities from Arunachal Pradesh, India, treating *C. sarcophyllum* var. *minor* as “*B. sarcophyllum* var. *minor* (King & Pantl.) Hegde & A.N.Rao (in press)”, although it seems this combination was never published. He differentiated *B. sarcophyllum* from *B. sarcophyllum* var. *minor* on the basis of an umbellate inflorescence of reddish-brown flowers in the former versus a sub-umbellate inflorescence of white flowers tinged purple in the latter. Similarly, Pearce & Cribb (2002) documented both *B. sarcophyllum* and *B. sarcophyloides* from Bhutan, citing *Pantling 95* (Rishap, Sikkim State, India) as the type for the former and *Pantling 95A* (Sivoke, Sikkim State, India) as the type of the latter. They also claimed that the specimens were in poor condition.

While searching for these types, the current authors came across two sheets at K both bearing the same number, *Pantling No. 95*, but with different dates. Sheet *K000829948* is labeled as *C. sarcophyllum* var. *minor* and was collected at 1000 feet from Sivoke and is dated 03/06/1891; the second sheet bears two plants, one labeled as *C. sarcophyllum* var. *minor* that was collected at 1500 feet in Sibchu, Independent Bhutan, in 05/1894 (accession *K000829947*), and a second, labeled as *C. sarcophyllum*, that was collected at 3000 feet in 09/1892 but which lacks a location (accession *K000829946*). A third sheet bearing the same collector number but marked “Sikkim, Rishap” exists in CAL.

In being the only sheet at CAL that bears the number *Pantling 95* with the collection locality specified as Rishap (now in West Bengal, India), this latter specimen conforms to the specifications of the holotype for *B. sarcophyllum* cited by Pearce & Cribb (2002). Similarly, in terms of collection location, sheet number *K000829948* at K matches the specifications of the holotype cited by these authors for *B.*



*sarcophylloides*, but it lacks a suffix of “A” after *Pantling 95* to confirm it as such. Since there are multiple collections labeled as *Pantling 95* also from Sivoke at CAL, we have added an “A” to the sheet at K to avoid future confusion.

**Global Distribution.** Bhutan and India.

**Specimens examined.** INDIA. Sikkim, Sivoke, 300 m, 3 June 1891, *Pantling No. 95A* (CAL0000000202) (CAL); Sikkim, Rishap, *Pantling 95* (K, CAL); Meghalaya, Rambhai, Jaintia Hills, July 1899, *Dr. Prain's Collector 256* (CAL0000054358) (CAL). BHUTAN. Sibchu, 450 m, May 1894, *Pantling No. 95* (CAL).

**4. *Bulbophyllum sarcophyllum*** (King & Pantl.) J.J.Sm., Bull. Jard. Bot. Buitenzorg, sér. 2, 8: 27 (1912); Seidenfaden (1973: 182, t. 93); Pearce & Cribb (2002: 476); Lucksom (2007: 710). *Cirrhopetalum sarcophyllum* King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 335 (1895). Type: India, Sikkim, Rishap, July 1892, *Pantling No. 95* (CAL0000000242) (holotype CAL!).

*Bulbophyllum panigrahianum* S.Misra, Nordic J. Bot. 6: 25 (1986). *Cirrhopetalum panigrahianum* (S.Misra) S.Misra, J. Orchid Soc. India 11: 54 (1997). Type: India, Orissa, Keonjhar, Rebana reserve forest, Rimbeda, 500 m, 11 July 1982, *S. Misra 698* (holotype CAL), *698A* (paratype K); India, Orissa, Kendughata, ca. 600 m, 13 July 1982, *S. Misra 750 & 751* (paratype K, L).

*Bulbophyllum cherrapunjeense* Barbhuiya & D.Verma, Phytotaxa 156: 298 (2014). **Syn. nov.** Type: India, Meghalaya, East Khasi Hills, Cherrapunjee, 1450 m, 7 July 2013, *Barbhuiya & Verma 112212* (holotype ASSAM).

**Taxonomic notes.** *Bulbophyllum cherrapunjeense* was differentiated from *B. sarcophyllum* and *B. sarcophylloides* by Barbhuiya & Verma (2014) on account of the presence of sheaths on the rhizome, its large spatulate leaf, 10–11-flowered umbels, two sterile bracts on the peduncle, and the greenish-yellow colour of its flowers; they neglected to mention *B. panigrahianum* (now accepted as a synonym of *B. sarcophyllum*), with respect to which Misra (1986) clearly states the sheaths on the rhizome are often lost, although annular scars of the sheaths persist. As for variation in flower colour and in the number of bracts and flowers, Vermeulen *et al.* (2015) say that wide size variation and floral colour dimorphisms are known in many species of *Bulbophyllum*, suggesting that these are not useful characters for species delimitation. Indeed, Hu *et al.* (2017a) found no genetic differences among different colour forms of *B. bicolor* Lindl., and both King & Pantling (1898) and Misra (2004) comment on variation in the number of flowers in *B. sarcophyllum*, for example.

In terms of the creeping rhizome, discoid bulbs spaced at 3–6 cm intervals and enclosed by a deciduous sheath (or fibrous remains of the sheath once it has fallen away), the umbellate inflorescence with sterile bracts present on the base as well as in the middle of the peduncle, filiform stelia 0.8–0.9 mm in length that project forward, and rounded column wings, *B.*

*cherrapunjeense* is inseparable from *B. sarcophyllum*, and is therefore here reduced to the synonymy of the latter. As discussed in the notes given under *B. sarcophylloides* above, Pearce & Cribb (2002) already specified the holotype for *B. sarcophyllum* (*Pantling 95*, CAL), although the condition of this specimen is poor.

**Global Distribution.** Bhutan, India, Myanmar and Nepal.

**Specimens examined.** INDIA. Sikkim, 900 m, Sept. 1892, *Pantling no. 95* (K000829946) (K).

**5. *Bulbophyllum scabratum*** Rchb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 259 (1861); Seidenfaden (1973: 67, t. 24); Pearce & Cribb (2002: 470). *Cirrhopetalum caespitosum* Wall. ex Lindl., Edwards's Bot. Reg. 24(Misc.): 35 (1838). Type: East Indies (likely Northeast India), under cultivation, *Duke of Devonshire s.n.* (holotype K). *Bulbophyllum confertum* Hook.f., Hooker's Icon. Pl. 21: t. 2035 (1890). *Phyllorkis conferta* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891). Type: India, Meghalaya, Khasi Hills, 1863–64, *Griffith 5170* (holotype K!).

#### Fig. 2B

*Bulbophyllum psychoon* Rchb.f., Gard. Chron., n.s., 9: 170 (1878). *Phyllorkis psychoon* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 677 (1891). **Syn. nov.** Type: India, Assam, collected by Freeman, *ex cult Bull. s.n.* (type not found). *Bulbophyllum lockii* Aver. & Averyanova, Komarovia 4: 5 (2006). Type: North Vietnam, Hoa Binh Province, Mau Chau District, Pa Co Municipality, 1150–1250 m, 2 Dec. 2003, *Phan Ke Loc P 10687* (holotype HN).

*Bulbophyllum levinei* Schltr., Repert. Spec. Nov. Regni Veg. 19: 381 (1924); Chen *et al.* (2009: 417); Barretto *et al.* (2011: 568). **Syn. nov.** Type: China, Guangdong, Lo Fou Shan, 800 m, Aug. 1917, *C.O. Levine 1548* (holotype B†). *Bulbophyllum insulsum* (Gagnep.) Seidenf., Dansk Bot. Ark. 29: 141 (1973); Seidenfaden 1992: 267. *Cirrhopetalum insulsum* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 22: 403 (1950). Type: Vietnam, Annam, station agricole de Blao Province, du Haut Donai, 800 m, 5 July 1933, *E. Poilane 22794* (holotype P!).

**Taxonomic notes.** Following Govaerts *et al.* (2017), we have three species, *B. psychoon* (= *B. lockii*), *B. levinei* (= *B. insulsum*) and *B. scabratum* (= *B. confertum*), to take into consideration in resolving the taxonomy of this group of similar plants with overlapping distribution ranges in Indochina. All three show similar vegetative (clustered pseudobulbs; elliptic to lanceolate solitary leaf ca. 6 cm long) and reproductive morphology (peduncle with two sterile bracts; off-white flowers; labellum lacking sidelobes, apex tapering, longitudinally grooved on the upper surface; column shortly winged below the stigma, bearing two protruding stelia 0.3–0.4 mm long). *Bulbophyllum levinei* has a dorsal sepal with an erose margin and divergent lateral sepals; in contrast, the dorsal sepal of *B. psychoon* is regarded as entire and the lateral sepals of this species are parallel; *B. scabratum* also has a dorsal sepal with an entire margin but its lateral sepals are either parallel or divergent. Variation in the placement of the lateral sepals, whether divergent,





convergent or parallel, is sometimes observed in flowers on the same inflorescence in *Bulbophyllum* (for example, as reported in *B. retusiusculum* by Lin & Wang 2014), hence this character cannot be considered significant for species delimitation. Furthermore, while studying living plants of *B. levinei*, we have observed that the margins of the dorsal sepal may appear entire when examined with the naked eye, but under a microscope they are certainly minutely erose. Similar observations were made with respect to *B. lockii* in Vietnam (Averyanov & Averyanova 2006, L. Averyanov, pers. comm.). We therefore find it likely that this character state has in many cases been overlooked by previous authors, and hence conclude that *B. psychoon* and *B. levinei* should be considered conspecific with *B. scabratum*.

**Global Distribution.** Bhutan, China, India, Laos, Nepal, Thailand and Vietnam.

**Specimens examined.** CHINA. Kwangtung Province, Lo Fou Shan, 9–27 Aug. 1917, *E.D. Merrill 10696* (isotype NMHN). Hong Kong, New Territories, Tai Mo Shan, Nov. 1989, *P.S. Choi 406* (HK); New Territories, Tai Mo Shan, 1 May 1973, *W. Allan & G. Barretto 22* (KFBG); New Territories, Tai Mo Shan, 1 July 1993, *N.H. Li & K.M. Lau 96* (CUHK); New Territories, Tai Mo Shan, 20 June 1975, *G. Barretto 13796* (CUHK); New Territories, Tai Mo Shan, 1 June 1974, *G. Barretto 84* (KFBG); New Territories, Tai Mo Shan, 2 June 1975, *G. Barretto 109* (KFBG); New Territories, Tai Mo Shan, 21 June 1989, *G. Barretto 378* (KFBG); New Territories, Tai Mo Shan, 6 July 2013, *P. Kumar 12041* (KFBG).

**6. *Bulbophyllum seidenfadenii*** A.D.Kerr in Seidenf., Dansk Bot. Ark. 29: 174 (1973); Schuiteman (2008: 271). Type: Laos, mountain range north of Vientiane, Ritaville, 750 m, 12 Jan. 1969, *A.D.Kerr 2826* (holotype C!). *Bulbophyllum seidenfadenii* A.D.Kerr, Amer. Orchid Soc. Bull. 42: 411 (1973). **nom. inval.**

#### Fig. 3

*Bulbophyllum jingdongense* A.Q.Hu, D.P.Ye & Jian W. Li, Phytotaxa: 200 (2017). **Syn. nov.** Type: China, Yunnan Province, Jingdong County, Pu'er, 1550 m, 17 Jan. 2016, *A.Q.Hu et al. 803* (holotype NOCC); Jingdong County, Pu'er, Yunnan Province, 1600 m, 11 March 2013, *Jian-Wu Li 2959* (paratype HITBC!); Yunnan Province, Jingdong County, Pu'er, 1570 m, 17 Feb. 2016, *Jian-Wu Li 4494* (paratype HITBC!); Laos, Khammouane Province, Nakai Dist., near Nam Theun Reservoir, 547 m, 25 Oct. 2014, *Gale, Kumar, Fischer, Bouamanivong, Phothisath & Phoumathap HNL-KFBG 0409* (HNL!).

**Taxonomic notes.** Kerr (1973) described *Bulbophyllum seidenfadenii* from Laos without citing a type in the text; he does refer to the specimen “ADK 2826” in his sketch of the species that accompanies the protologue, but this cannot be considered a type citation and so the name is rendered invalid. Subsequently, Seidenfaden (1973a) inadvertently validated this name by providing a type (*A.D.Kerr 2826*) and location (C). Authorship remains with Kerr, as Seidenfaden did not provide any additional Latin diagnosis (Article 46, McNeill *et al.* 2012).

In the original publication of *B. seidenfadenii* by Kerr (1973), there exists a contradiction in the description of

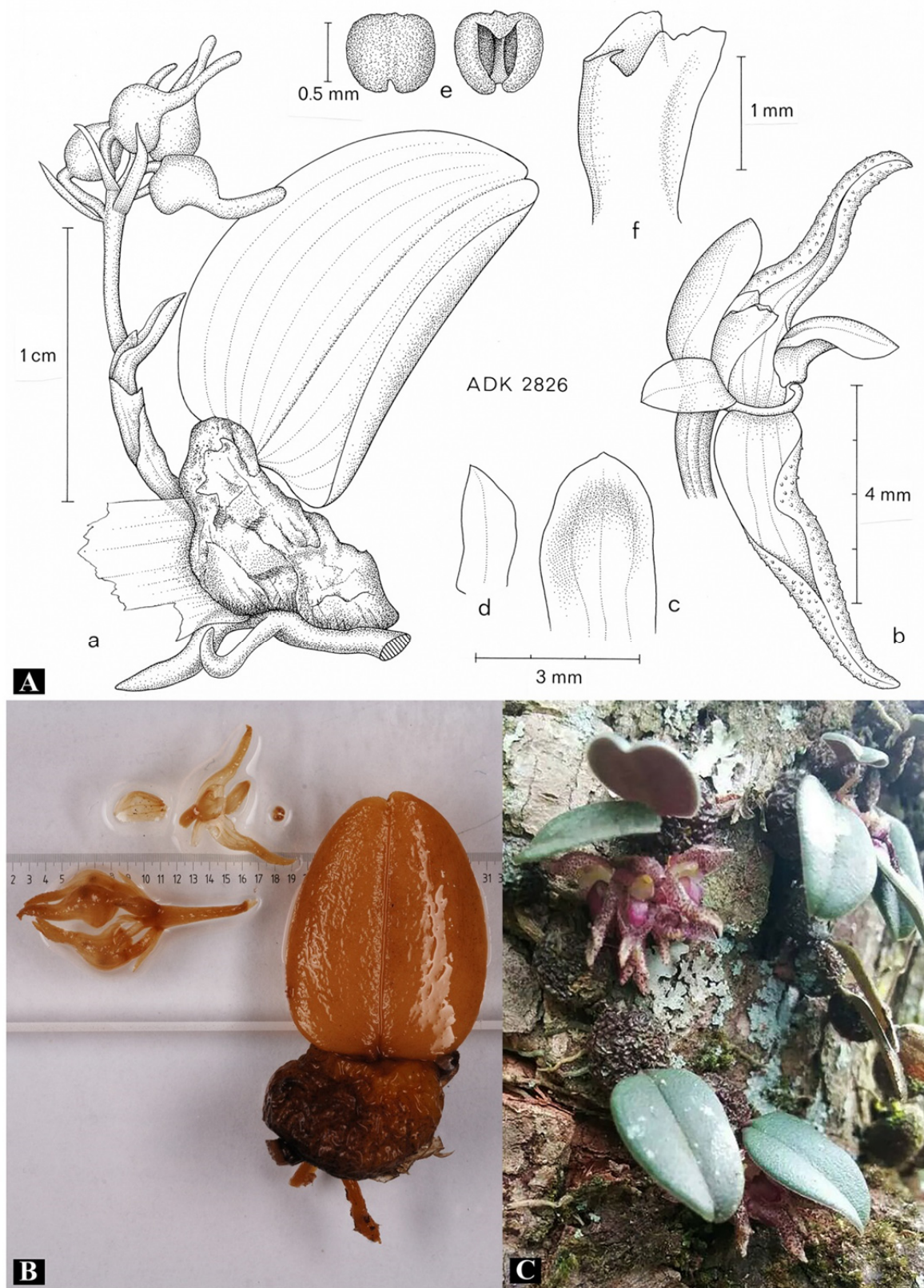
the pseudobulbs: in the printed text, Kerr states the pseudobulb to be 24 mm in diameter, but in the handwritten notes annotating the illustration (not numbered) he writes, “bulbs to 14 mm in diam.”. The correct dimensions are clarified in the scaled illustration provided by Seidenfaden (1973: t. 87; reproduced in Fig. 3A), which is in fact a redrafted version of Kerr’s original. We re-examined the type specimen at Copenhagen and confirm the single pseudobulb to measure approximately 11 mm in diameter (Fig. 3B). It is also evident from Kerr’s handwritten notes on his illustration that his analysis was based on a dissection of buds and not fully open flowers (“*Ls* [lateral sepals] *presumably connate except under the lip but difficult to ascertain as plant in bud*”), and we confirm that the type contains only a single inflorescence comprising five flowers in bud, of which one has been opened; hence it is likely that there would be a degree of inaccuracy in the measurements of floral parts based on this specimen alone.

*Bulbophyllum seidenfadenii* (Kerr 1973) and *B. jingdongense* (Hu *et al.* 2017b) both belong to the “*Cirrhopetalum* alliance” and exhibit similar vegetative morphology (pseudobulbs globose, subglobose or ovoid, oblique or not, wrinkled, olive-green or reddish-purple, 5.0–14.0 mm in diameter, 4.2–9.3 mm tall, placed at 2.5–12.5 mm intervals and embedded in the rhizome to give the impression that the roots are emerging directly from the pseudobulbs; leaf solitary, elliptic, orbicular or ovate, acute or obtuse, equally or unequally 2-lobed, 7–11 veined, dark to dull green above, purple underneath) as well as reproductive characters (peduncle 6–11 mm long, with 2–3 sheaths at base, bearing 4–6 purple-spotted flowers in an umbellate arrangement; labellum without sidelobes; column with broad stelidia), both of which are rather variable between plants. Although Hu *et al.* (2017b) reported the stelidia in *B. jingdongense* to be “basally truncate, apex acuminate, ... merging with the column wings at apex”, we find this description to be essentially consistent with the broad stelidia present in *B. seidenfadenii*. Hu *et al.* (2017b) also specifically mention the presence of a conspicuous gland below the stigma on the column in *B. jingdongense*, and although neither Kerr (1973) nor Seidenfaden (1973a) refer to an equivalent structure in *B. seidenfadenii*, re-examination of the type specimen confirms the presence of a distinct, transversely ellipsoid projection (we are unable to confirm whether this is a gland or not) on the ventral side of the column. Although rarely mentioned in descriptions of *Bulbophyllum* species, ‘glands’ below the stigma are not uncommon in the genus (e.g. Verma *et al.* 2015). Hence, we conclude that *B. jingdongense* should be regarded as a synonym of *B. seidenfadenii*.

**Global Distribution.** China and Laos.

**Specimens examined.** CHINA. Jingdong County, Pu'er, Yunnan Province, 1600 m, 11 March 2013, *Jian-Wu Li 2959*





**Fig. 3.** *Bulbophyllum seidenfadenii*. **A.** Figure 87 from Seidenfaden (1973a); **B.** Type specimen A.D. Kerr 2826 at Copenhagen (C); **C.** Plants in the wild in China. Credits: **A** drawn by K. Olsen and reproduced under an agreement between the artist and the Botanical Museum (now Natural History Museum of Denmark). Photo credits: **B** by Henrik Æ. Pedersen; **C** by Bingmou Wang.



(HITBC); Jingdong County, Pu'er, Yunnan Province, 1570 m, 17 Feb. 2016, *Jian-Wu Li 4494* (HITBC). **LAOS.** Khammouane Province, Nakai Dist., near Nam Theun Reservoir, 547 m, 25 Oct. 2014, *Gale, Kumar, Fischer, Bouamanivong, Phothisath & Phoumaphap HNL-KFBG 0409* (HNL).

**7. *Bulbophyllum tipula*** Aver., Taiwania 61: 326 (2016). Type: Northern Vietnam, Ha Giang Province, Bac Me District, Phieng Luong Municipality, around Phieng Luong Village, 1100–1150 m, 27 June 2016; *L.Averyanov, N.T.Hiep, N.S.Khang, T.Maisak, L.Osinovetz CPC 7398a/TM 1133* (holotype LE); Digital epitype–d-Exsiccates of Vietnamese Flora 0256/CPC 7398a / TM1133 (epitype LE!).

*Bulbophyllum lipingtaoi* J.X.Huang, J.Y.Wang & Z.J.Liu, Phytotaxa: 221 (2017). **Syn. nov.** Type: China, Yunnan, Malipo, 1280 m, 3 Aug. 2008, *Liu 4049* (holotype NOCC).

**Taxonomic notes.** Averyanov *et al.* (2016b) described *Bulbophyllum tipula* from northern Vietnam, noting that it bears no clear affinity to any other known species and hence could not be assigned to any particular section.

Wang *et al.* (2017) published *B. lipingtaoi* from China and compared it with *B. japonicum*, *B. muscicola* and *B. omerandrum*. According to their phylogram, the new species was found to be close to *B. japonicum* and hence they placed it in section *Brachyantha* Rehb.f.

*Bulbophyllum lipingtaoi* shares virtually identical morphological traits and dimensions with *B. tipula* (diminutive, scrambling epiphyte with rugose pseudobulbs; inflorescence emerging from base of pseudobulb or rhizome node, bearing up to 3 sterile bracts; solitary flower with entire, ovate dorsal sepals, elongate lanceolate lateral sepals up to 2 cm long and a labellum lacking side lobes; column with a forward curving foot at base, small, rounded wings and minute, triangular stelidia). Malipo, the type locality of *B. lipingtaoi*, lies within 80 km of Bac Me District in northern Vietnam, and the habitat at both sites is humid evergreen forest on limestone karst above 1000 m elevation. We conclude that *B. lipingtaoi* should be synonymised under *B. tipula*.

**Global Distribution.** China and Vietnam.

**8. *Cleisostoma lecongkietii*** Tich & Aver., Taiwania 60: 113 (2015). Type: Southern Vietnam, Binh Thuan (Phan Thiet), Dak Nong (Nam Nung Nature Reserve), *Nguyen Thien Tich no Tich 00.09.98* (holotype - Herbarium of the Department of Botany and Ecology, University of Science, Ho Chi Minh City Vietnam National University).

*Cleisostoma yersinii* J.Ponert & Vuong, PLoS ONE 11 (3): e0150631 (6) (2016). **Syn. nov.** Type: Vietnam, Khanh Hoa Province, Cam Lâm District, Hòn Bà Nature Reserve, 8 Sept. 2013, *Jan Ponert 674 (PRC455377)* (holotype PRC!).

**Taxonomic notes.** Averyanov *et al.* (2015) described *Cleisostoma lecongkietii*, a large monopodial

epiphyte bearing a pendulous inflorescence, from southern Vietnam. He noted that it does not match any known member of the genus, owing to its large flowers with a subglobular, fleshy labellum and large column with rectangular, concave and forward-projecting wings. He found this species so unique that he established a new section to accommodate it, namely section *Pterogyne* Aver. Ponert *et al.* (2016) described *C. yersinii* also from southern Vietnam (approximately 150 km away from Averyanov's type locality) but they compared their species with *C. birmanicum*.

Given identical morphological characters of both vegetative and reproductive parts (alternate distichous leaves with bilobed apex; fleshy sub-globular labellum; column bearing rostellar wings on either side; pollinia with saddle-shaped viscidium), *C. yersinii* is reduced to the synonymy of *C. lecongkietii*. This species is certainly similar to *C. birmanicum* and may well fit within section *Echinoglossa* (Blume) Seidenf., which comprises species with dorsiventrally flattened leaves, a labellum bearing a bifurcate appendage at the apex, and a complex pollinarium morphology (Seidenfaden 1975b; Pridgeon *et al.* 2014). Accordingly, section *Pterogyne* is probably better merged with section *Echinoglossa*.

**Global Distribution.** Vietnam.

**9. *Coelogyne ovalis*** Lindl., Edwards's Bot. Reg. 24(Misc.): 91 (1838); King & Pantling (1898: 135, t. 187); Seidenfaden (1975c: 23, t. 6); Chowdhery (1998: 234); Pearce & Cribb (2002: 327); Chen *et al.* (2009: 318). Type: Nepal, *N.Wallich 1957/1* (holotype K-W!). *Coelogyne arunachalensis* H.J.Chowdhery & G.D.Pal, Nordic J. Bot. 17: 369 (1997); Chowdhery (1998: 214). Type: India, Arunachal Pradesh, Lower Subansiri District near Doi Mukh, on way to Sagali, 500–800 m, 2 Nov. 1985, *G.D.Pal 1790* (holotype CAL). **Fig. 2D**

*Coelogyne mishmensis* Gogoi, *Richardiana* 16: 375 (2016). **Syn. nov.** Type: India, Arunachal Pradesh, Lower Dibang Valley District, Mehao Wildlife Sanctuary, 24 July 2016, 800 m, *Khyanjeet Gogoi 0765* (holotype CAL).

**Taxonomic notes.** *Coelogyne ovalis* was originally described from Nepal (Lindley 1838) and is now known to be widespread throughout the eastern Himalaya, South China and Indochina (Govaerts *et al.* 2017), whereas *C. mishmensis* was described from Arunachal Pradesh in northeast India (Gogoi 2016). Both species exhibit similar or overlapping vegetative as well as reproductive characters (pseudobulbs placed at 4.5–12.0 cm intervals, 3.0–8.0 cm tall; flowers greenish-yellow to yellow, ca. 4.0 cm across; dorsal sepal ovate-lanceolate to oblong-lanceolate, up to 3 cm long; petals linear; labellum 3-lobed, 2.5–3.0 cm long, the mid-lobe densely ciliate, the disc bearing two wavy lamellae that extend from the base to the apex and converge at both ends, and with a third inconspicuous,



shorter lamella in the middle; column slightly winged at the apex). We find no significant morphological character with which to distinguish *C. mishmensis* from *C. ovalis*.

**Global Distribution.** Bhutan, China, India, Laos, Myanmar, Nepal, Thailand and Vietnam.

**Specimens examined.** LAOS. Khammouane Province, Nakai District, Nakai Protected Area, near Houay Ma Lay Village, Gale, Kumar, Fischer, Bouamanivong, Phothisath & Phoumathap HNL-KFBG 0399 (HNL).

**10. *Dendrobium chapaense*** Aver., Rheede 16: 3 (2006). Type: Vietnam, Lao Cai Province, Sa Pa District, vicinity of Sa Pa, 1500–2000 m, 25 Nov. 2005, L.V.Averyanov, P.K.Loc, HAL 8321 (holotype LE).

*Dendrobium longlingense* Q.Xu, Y.B.Luo & Z.J.Liu, Phytotaxa 174: 140 (2014). **Syn. nov.** Type: China, Yunnan, Longling, 1650 m, 10 Feb. 2014, Liu 7454 (holotype NOCC).

**Taxonomic notes.** *Dendrobium chapaense* was described from northern Vietnam by Averyanov (2006), whereas *D. longlingense* was described from nearby Yunnan Province in southwest China by Xu *et al.* (2014); both were differentiated from *D. longicornu* as their putative closest ally. Following close examination of the original descriptions, high quality photos and line drawings available in both protologues (Averyanov 2006, Xu *et al.* 2014), it is clear that the two entities share many identical morphological characters, in terms of both vegetative and reproductive parts, notably the presence of black hairs on the stem, an inflorescence bearing one to three white to pale orange flowers, a cylindrical pedicel and ovary 2.0–3.0 cm long, ovate-triangular lateral sepals that are ca. 2.0 cm long, a subflabellate or ovate-rhomboid, 3-lobed lip that is ca. 2.5 cm long and wide, with ovate lateral lobes and a disc bearing one thick orange-red fleshy, undulate and denticulate ridge, a backward-pointing spur that is slightly bent ca. 1.0 cm before the tip, and a column ca. 4.0 mm long. These overwhelming similarities suggest that *D. longlingense* is conspecific with *D. chapaense*.

**Global Distribution.** China, India and Vietnam.

**11. *Dendrobium crepidatum*** Lindl. & Paxton, Paxton's Fl. Gard. 1: 63 (1850); Hooker (1890: 740); King & Pantling (1898: 48, t. 66); Seidenfaden (1972: 118; 1975a: 42; 1985: 80); Seidenfaden & Smitinand (1960: 212); Pearce & Cribb (2002: 408); Misra (2004: 442); Kumar *et al.* (2007: 301); Schuiteman *et al.* (2008: 281); Chen *et al.* (2009: 380). *Callista crepidata* (Lindl. & Paxton) Kuntze, Revis. Gen. Pl. 2: 654 (1891). Type: India, Hort. Rollinson, 1 June 1847, *sine coll.*, *sine no.* (K001089606) (lectotype K-LINDL! selected here).

#### Fig. 2E–F

*Dendrobium maguanense* Q.Xu & Z.J.Liu, Phytotaxa 286: 50 (2016). **Syn. nov.** Type: China, Yunnan, Maguan, 1350 m, 12 Dec. 2013, Liu 7262 (holotype NOCC).

**Taxonomic notes.** Lindley & Paxton (1850) described *Dendrobium crepidatum* from a leafless plant in flower that was sent from India, but they did not cite a type. Two illustrations of *D. crepidatum*, both on the same sheet, exist in the Lindley Herbarium at K, each having been assigned its own herbarium accession number: K001089606 (P. Basset, April 1, 1850), which matches the figure presented in the protologue, and K001089607 (Hort. Rollinson, June 1, 1847), the date of which matches that given in the description. As K001089606 depicts three flowers, part of the stem and a detail of a single flower (compared to just single flower for K001089607), we hereby select it as the lectotype for *D. crepidatum*.

*Dendrobium maguanense* was recently described from Maguan in Yunnan Province, China (Xu *et al.* 2016), and was differentiated from *D. crepidatum* and *D. crystallinum* Rchb.f. in having smaller flowers, white, oblong sepals, white, obovate-elliptic petals and an ovate, concave and narrowly clawed lip bearing a white frontal margin. When the type of *D. crepidatum* is compared with *D. maguanense*, similar and indeed overlapping morphological characters are observed. Thus in both, the stem is abruptly swollen at the base and its internodes are covered with the remains of a sheathing leaf base, leaving white striations; both are flowering in the leafless condition; the inflorescence bears one or two flowers; the flowers are pinkish-white to white with a yellow labellum that has a white apical margin; the sepals are oblong, 1.3–1.4 cm long and 0.5–0.6 cm wide; the petals are obovate, approximately 1.3 cm long, and 0.4–0.6 cm wide; the labellum is approximately 1.6 cm long and 1.2 cm wide, concave, narrowly clawed at the base, the disc is slightly thickened and bears three faint ridges arising from the base and terminating at the apex, with hairs irregularly spread over the surface. *Dendrobium crepidatum* occurs in various colour forms (white and pink) and such colour variants are known in many other species of *Dendrobium*, including *D. pachyphyllum* (Kuntze) Bakh.f., *D. polyanthum* Wall. ex Lindl., *D. chrysotoxum* Lindl., etc. (Wood 2006). Accordingly, *D. maguanense* is hereby reduced to the synonymy of *D. crepidatum*.

**Global Distribution.** Bangladesh, Bhutan, Cambodia, China, India, Myanmar, Nepal, Laos, Thailand and Vietnam.

**Specimens examined.** LAOS. Vientiane Province, Vang Vieng District, Phou Din Deng, 498 M, 30 April 2012, Fischer, Gale, Kumar, Bouamanivong, Santainsy & Phunthavong HNL-KFBG 0238 (HNL); Xayaboury Province, Nahai Village, Pha Xang Mts 773 m, 28 June 2016, Gale, Kumar, Phothisath & Sysouphanthong HNL-KFBG 0638 (HNL).

**12. *Dendrobium wattii*** (Hook.f.) Rchb.f., Gard. Chron., ser. 3, 4: 725 (1888); Hooker (1890: 721); Seidenfaden & Smitinand (1960: 222); Averyanov *et al.* (2016: 209). *Dendrobium cariniferum* var. *wattii*



Hook.f., Bot. Mag. 109: t. 6715 (1883). *Callista wattii* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 655 (1891). Type: India, Manipur, on ascent to Seriphari, 2700 m, 16 June 1882, *G. Watt 5944* (holotype K!).

*Dendrobium vocongii* Schettler & D.M. Pham, OrchideenJ. 4 (1): 3 (2016), **nom. inval.** Type: Vietnam, Kon Ka Kinh (cultivated in Kontum by Mr. Vo Van Cong, original collector, and bloomed at his nursery), 1000 m, March 2016, *Pham 3/2016 VNP16301*.

*Dendrobium congianum* Aver., Taiwaniana 61: 336 (2016). **Syn. nov.** Type: Vietnam, prepared from cultivated plant, 25 April 2016, *L. Averyanov AL 123* (holotype LE!).

**Taxonomic notes.** Hooker (1883) originally described *Dendrobium cariniferum* var. *wattii* from Manipur, India, but this taxon was later recognised as a distinct species, *D. wattii*, by Reichenbach (1887), a position that was supported by Seidenfaden (1985).

Averyanov *et al.* (2016c) and Schettler & Pham (2016) described *D. congianum* and *D. vocongii*, respectively, both from cultivation in Vietnam. However, the name *D. vocongii* stands invalid according to article 40.7 of ICN (McNeill *et al.* 2012), because the herbarium where the type was deposited was not stated.

Overall characteristics of *D. wattii* match those of *D. congianum* and *D. vocongii* owing to the fact that they all bear similar white flowers comprising an ovate dorsal sepal with an acute to acuminate apex; ovate to obovate lateral sepals with an oblique base and acuminate apex; obovate petals with an apiculate apex; a rhomboid, 3-lobed labellum with raised, obliquely obovate, rounded sidelobes that have crenate to crenulate margins, and an obovate mid-lobe that has a dentate to denticulate margin; and a disc bearing a fleshy keel that extends from the base of the labellum to the base of the mid-lobe. The shape and size of *D. vocongii* flowers are a close match for the size and shape of *D. wattii* flowers; the somewhat smaller flowers of *D. congianum* (2.3–3.5 cm wide) fall at the lower end of the range of flower size in *D. wattii* (3.5–5.0 cm wide), but the measurements are nevertheless continuous. The yellow-orange spot at the centre of the labellum in *D. wattii* is completely missing in *D. congianum*, but there are many other species of *Dendrobium* (such as *D. catenatum*, *D. chrysotoxum*, *D. fimbriatum*, *D. moniliforme*, etc.) which exhibit a similar polymorphism in the presence or absence of coloured spots on the labellum (Zhu *et al.* 2009). The structure of the flower and labellum in the illustration presented by Seidenfaden (1985; Fig. 70), which is based on the same specimen studied by Reichenbach in 1888 (*Reichenbach 32457* (K)), matches well with the description and plate given by Averyanov (2016c; Fig. 10), except that the stem is somewhat more swollen in *D. congianum* and *D. vocongii*, although this may just be due to different growing conditions. Based on these considerations, both *D. congianum* and *D. vocongii* are

merged with *D. wattii*.

**Global Distribution.** Bhutan, China, India, Laos, Myanmar, Thailand and Vietnam.

**13. *Habenaria gibsonii* var. *foetida* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 36: 16 (1932); Misra (2004: 186); Kumar (2007: 300). Type: India, Maharashtra, Khandala, Monkey Hill, *Hallberg s.n.* (holotype BLAT).**

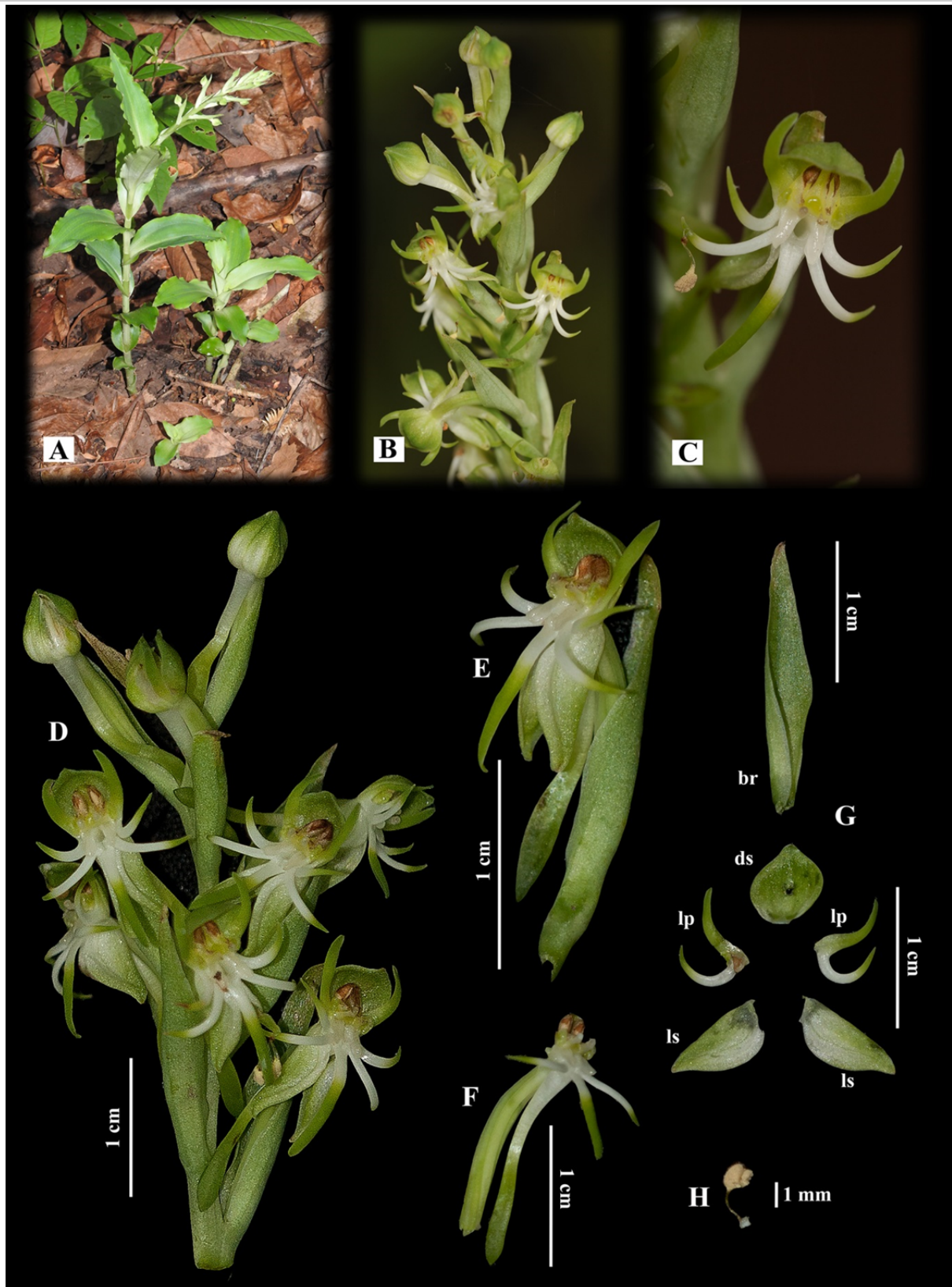
**Fig. 4**

*Habenaria thailandica* Seidenf., Dansk Bot. Ark. 31: 78 (1977); Seidenfaden 1992: 56; Kurzweil (2009: 23; 2011: 142). **Syn. nov.** Type: Thailand, Northern Chiang Mai, foothills of Doi Chiangdao, 7 June 1973, *Geesink, Phanichapol, Santisuk 5759* (L 0061379) (holotype L!).

**Taxonomic notes.** Seidenfaden (1977) described *Habenaria thailandica* from Thailand with hesitation, owing to the fact that he had not studied the *Habenaria digitata*-complex from places outside Thailand, especially in the Himalayan and Deccan regions of India. Later, Kurzweil (2009, 2011) followed Seidenfaden's treatment but did not attempt to revise the complex by consulting the Indian specimens.

Validating Seidenfaden's hesitation, *H. thailandica* turns out to be a close match for *H. gibsonii* (plants ca. 50 cm tall, with globose tubers and leaves scattered along the stem; inflorescence laxly many-flowered; floral bracts longer than the ovary; flowers greenish-white, ca. 2 cm across; dorsal sepal ovate, almost obtuse; lateral sepals obliquely ovate to oblong-lanceolate; petals 2-lobed almost at the base, both lobes falcate but the upper lobe longer than the lower one; labellum 3-lobed, all lobes filiform, the side lobes shorter and recurved, the midlobe pendulous; spur clavate, shorter than or as long as the ovary). *Habenaria gibsonii* is a species represented by two varieties, both of which were originally described from the Khandala region of India (Blatter & McCann 1932), and with both later found also in Orissa (Misra 2004) and Jharkhand (Kumar *et al.* 2007). Variety *foetida* is differentiated from the homotypic form in possessing foul smelling flowers and relatively short stigmatic processes up to 1.5 mm long that are appressed around the mouth of the spur, whereas the latter has apparently odourless flowers with relatively long stigmatic processes up to 2.5 mm long that are appressed only to the back of the mouth of the spur. Although the flowers belonging to our recent collection of plants in Laos (Kumar *et al.* *HNL-KFBG1161*) emitted a pungent odour, most authors that have examined this group of closely related species have not commented on whether or not the material available to them possessed a floral odour, probably because they were working with herbarium specimens and not fresh material. Because a thorough investigation of the stability of these rather minor and perhaps dubious differences within and between populations is beyond the scope of the present





**Fig. 4.** *Habenaria gibsoni* var. *foetida*. **A.** plant in habitat; **B.** close-up of inflorescence; **C.** close-up of flower; **D.** close-up of inflorescence; **E.** close-up of flower; **F.** labellum with spur and ovary; **G.** br-bract, ds-dorsal sepal, lp-lateral petal, ls-lateral sepal; **H.** pollinarium. Photographs and plate by Pankaj Kumar.



paper, for now we maintain the two varieties as distinct. Seidenfaden (1977, Fig. 42) depicts *H. thailandica* with short stigmatic processes appressed to more or less the full circumference of the spur opening, but he does not comment on floral aroma and we are unable to confirm whether or not its flowers are foul smelling. In fact, it is conceivable that flower odour varies from plant to plant, and that pungency is temporally variable throughout the day and during the lifespan of a single flower, as noted for other orchids (Gregg 1983). Until further information on this character becomes available, we regard *H. thailandica* as a synonym of *H. gibsonivar. foetida* based on the relative length and placement of its stigmatic processes alone

**Global Distribution.** Cambodia, India, Laos, Thailand and Vietnam.

**Specimens examined.** INDIA. Jharkhand, Ranchi, July 2004, *P.Kumar 041178* (WII); Jharkhand, Ranchi, July 2005, *P.Kumar 051018* (WII). LAOS. Xekong Province, Lemam District, Xe Noy Village, Phou Luang Mt, 351 m, 23 May 2017, *Kumar, Bouamanivong & Phaxaysombath HNL-KFBG 1161* (HNL).

**14. *Habenaria malintana*** (Blanco) Merr., Sp. Blancoan.: 112 (1918); Seidenfaden (1977: 126, t. 79; 1992: 67); Chen *et al.* (2009: 157); Kurzweil (2009: 43) Kurzweil *et al.* (2011: 121). *Thelymitra malintana* Blanco, Fl. Filip.: 642 (1837). Type: Philippines, Luzon, Bulacan Province, Obando, Oct. 1914, *E.Merrill 629* (holotype P!). **Fig. 2C**

*Habenaria pelorioides* C.S.P.Parish & Rchb.f., Trans. Linn. Soc. London 30: 139 (1874); Hooker (1890: 166); Misra (2004: 231); Kumar (2007: 300). Type: Myanmar, Tennaserim, by the seaside, 1862, *Amherst s.n. (K000247491)* (holotype K!)

*Odisha cleistantha* S.Misra, Orchids India: 252 (2007). **Syn. nov.** Type: India, Orissa (Odisha), Mayurbhanj District, Simlipal, near Gudugudia, 600 m, 27 Sept. 2004, *Sarat Misra 2434* (holotype CAL).

*Habenaria luceana* Aver., Taiwania 55: 95 (2010). **Syn. nov.** Type: Vietnam, Dac Lac Province, Buon Don District, Krong Na Municipality, Yok Don National Park, 200 m, 27 March 2008. *N.T.Hiep, Averyanov L., P.K.Loc, N.T.Vinh, N.S.Khang, T.H.Thai, N.V.Trai, HLF 7407b* (holotype HN); Digital epitype -d-Exsiccates of Vietnamese Flora 165/HLF 7407b (LE!)

**Taxonomic notes.** Blanco (1837) described *Thelymitra malintana* from the Philippines, but Merrill (1918) transferred this entity to the genus *Habenaria* as *H. malintana*, noting that *H. pelorioides* was identical and should therefore be treated as conspecific with *H. malintana*. When studying *H. dentata* (Sw.) Schltr. from Thailand, Seidenfaden (1977) examined the type of *H. pelorioides* and accepted its synonymisation but also suggested that *H. malintana* is identical to *H. dentata* on the basis of their lanceolate lip that lacks sidelobes and a spur. Nevertheless, he declined to formally merge the two, preferring to avoid “getting into a time consuming study”, and this position was followed by Kurzweil (2009, 2011).

Parish & Reichenbach (1874) described *H. pelorioides* based on Amherst’s collection from Tennaserim, Myanmar. As the species epithet suggests,

they considered it a peloric form of some other unidentified species. Hooker (1890b) reported *H. pelorioides* from erstwhile British India, without providing any specific locations but also noting that it is likely to be a peloric form. Vatsala (1975) reported *H. pelorioides* from Kerala, with their material matching exactly the type from Myanmar. Manilal & Kumar (2004) also reported *H. pelorioides* from Kerala but claimed that it had been wrongly synonymised under *H. dentata* by Seidenfaden (1977), which, in actual fact, was never the case, as noted in the previous paragraph. Misra (2004) reported *H. pelarioides* from Orissa, but his plant had a labellum with three lobes, triangular column processes located at the base of the anther locules, and indistinct pollinia that were not easily separable and which lacked antherophores. Later, Misra (2007) cited the unusual gynostemium anatomy in concluding that his specimen from Orissa was actually distinct from *H. pelorioides*, establishing the monotypic subtribe *Odishinae* and genus *Odisha* to accommodate it under the name *Odisha cleistantha*. However, all of these observations in fact point towards the peloric nature of the flowers.

Kumar *et al.* (2007) reported *H. pelorioides* from the Chotanagpur Plateau (*P.Kumar 021066 & 021078* (WII!)) adjacent to the state of Odisha. Although this entity was a good match for *O. cleistantha* in overall morphology, the plants had lobed petals and an entire labellum, indicating a close affinity to *H. luceana* described from Vietnam by Averyanov (2010a). Averyanov (2010a, 2010b) had already indicated that *H. luceana* was close to *H. geniculata* var. *ecalcarata* King & Pantl., *H. malintana*, *H. parageniculata* Tang & F.T.Wang and some forms of *H. dentata*, but distinct on the basis of its barely opening flowers with mucronate sepals, divided petals and short, triangular, fleshy lip.

Based on the foregoing discussion and details of the original descriptions, it is evident that, at the very least, all authors (except Averyanov 2010a, 2010b) agree that the flowers of *H. malintana* are peloric. Most of the claims of Misra (2007) upon which he circumscribed *O. cleistantha* stem from the fact that none of the previous authors gave any details of the column, rostellum and pollinia. Illustrations of the rostellum and pollinarium provided by Misra (2004) do not match well his own subsequent illustrations published later (Misra 2007), again strongly suggesting a degree of inconsistency in floral morphology that can be attributed to peloric deformity. *Habenaria dentata* is a widespread species occurring throughout much of tropical, subtropical and warm temperate Asia. The peloric *H. malintana* is recorded from parts of India and Indochina, with varying levels of deformity reported within this range. The two entities, *H. dentata* and *H. malintana*, even co-occur at some places in Thailand (Kurzweil 2009;



H.Æ. Pedersen, personal observation). Similar observations have been made on *H. reniformis* (D. Don) Hook. f., in which plants have been seen to bear a 1–3-lobed labellum with or without a distinct spur (Averyanov 2010b, Barretto *et al.* 2011).

Pelorism has been broadly documented within the Orchidaceae and other families and is generally held to amount to no more than an infraspecific mutation (Rudall & Bateman 2003; Mondragón & Theissen 2011). In addition to these spurless and completely or partially cleistogamous forms, several ‘abnormal’ open-flowered forms, which may or may not lack a spur, have also been described, either as new varieties or species, such as *H. dentata* var. *parageniculata* (Tang & F. T. Wang) Aver. and *H. finetiana* Schltr. These are all almost certainly derived from *H. dentata*, but a comprehensive treatment of all names that takes population genetic data and pollination biology into consideration is beyond the scope of the current paper. For now, we reduce only the closed- or partially closed-flower forms to the synonymy of *H. malintana*.

**Global Distribution.** China, India, Laos, Lesser Sunda Islands, Myanmar, Nepal, Philippines, Thailand and Vietnam.

**Specimens examined.** INDIA. Orissa (Odisha), Mayurbhanj District, Simlipal, near Gudugudia, 600 m, 27 Sept. 2004, Sarat Misra 2434 (CAL); Jharkhand, Latehar, Netarhat, P. Kumar 021066 (WII).

**15. *Luisia zeylanica*** Lindl., Fol. Orchid. 4: 3 (1853); Seidenfaden (1971: 62, t. 33); Misra (2004: 665); Kumar *et al.* (2007: 302). Type: Sri Lanka, 1829, *Macrae 50* (lectotype K-LINDL! selected here). *Cymbidium triste* Roxb., Hort. Bengal. 63 (1814), **nom. invalid.** Type: India, Delta of Ganges, *W. Egerton, Esq. 1809* (specimen not found).

*Luisia indica* Khuraijam & R. K. Roy, Biodivers. J. 6: 699 (2015). **Syn. nov.** Type: India, Bihar, West Champaran, Valmiki Tiger Reserve, 13 March 2015, J. S. Khuraijam 101206 (holotype LWG).

**Taxonomic notes.** The combination *Cymbidium triste* has been published multiple times by different authors, two of which are of significance in relation to the taxonomy of the plant now known as *Luisia zeylanica*. The first is that made by Willdenow (1805), who transferred *Epidendrum triste* G. Forst., a plant collected from New Caledonia (Forster 1786), to *Cymbidium*. This taxon was later transferred once more into the genus *Luisia*, as *L. tristis*, by Hooker (1890), although he admitted that he had not seen Forster’s plant, instead basing his combination on another specimen collected by Curtis in Penang. Seidenfaden (1971) examined both Forster’s plant from New Caledonia and Curtis’s from Penang, and found them to be distinct. Hooker’s species therefore needed a new name, for which Seidenfaden (1973) published *L. curtisii*.

Apparently unaware of Willdenow’s combination, Roxburgh (1814) published *C. triste* based on a specimen from the “Delta of Ganges” (*W. Egerton, Esq. 1809*). Recognising the duplication and misuse of the name *C. triste* (including a third *C. triste* published by Griffith (1851)), Lindley (1853) created the new name *L. zeylanica* based on a Macrae collection (*Macrae 50*) from Sri Lanka, under which he placed Roxburgh’s *C. triste* as a synonym. It is evident that Lindley studied two specimens, *Macrae 50* from Sri Lanka and *W. Egerton 1809* from Delta of Ganges, hence there is a need to select a lectotype for *L. zeylanica*. *Macrae 50* is present at K, and it comprises a complete plant with flowers as well as an illustration on the sheet, and is hence here chosen as the Lectotype.

Compounding the confusion, Govaerts *et al.* (2017) unfortunately list *L. zeylanica* as a synonym of *L. tristis* (G. Forst.) Hook. f., despite them being taxonomically distinct: for the latter, Seidenfaden (1973) had already validly created the new name *L. curtisii*.

*Luisia indica*, described from India by Khuraijam & Roy (2015), exhibits similar morphological characters to *L. zeylanica* (both plants having terete leaves that taper a few centimeters before the apex, 5-veined petals and sepals, a labellum with a distinct partition between the epichile and hypochile, and the hypochile bearing small (1–2 mm long) triangular side lobes), and occurs within the distribution range of latter. This entity is therefore placed under the synonymy of latter.

**Global Distribution.** Bhutan, India, Nepal and Sri Lanka.

**Specimens examined.** INDIA. Jharkhand, Cardon 456775 (CAL); Jharkhand, Chhotanagpur, P. Kumar 031017 (WII); Orissa, Ghatgaon, G. Panigrahi 8421 (CAL); Uttarakhand, Dehradun, P. W. Mackinnon 456781 (CAL); Sikkim, Pantling 205 (CAL); Assam, Jaintia Hills, Narpoh, Prain’s Collector 257 (CAL).

**16. *Phalaenopsis pulcherrima*** (Lindl.) J. J. Sm., Repert. Spec. Nov. Regni Veg. 32: 366 (1933). *Doritis pulcherrima* Lindl., Gen. Sp. Orchid. Pl.: 178 (1833); Chen *et al.* (2009: 446). Type: Vietnam, Turon (=Tourane = Danang), undated, *Finlayson 521* (Wall. Cat. 7348) (holotype K-W!).

*Doritis boubettii* Telepova, Rhône-Alpes Orchid. 50: 7 (2013). **Syn. nov.** Type: Cambodia, Kompong Speu, Phnom Kulen, 200 m, Dec. 2010, Telepova, Larpin, Jeanelos 813 (holotype P!).

*Doritis pulcherrima* f. *cinnabarina* Telepova, Rhône-Alpes Orchid. 50: 11 (2013). **Syn. nov.** Type: Cambodia, Koh Hong, Koh Rong Samloem, 200–300 m, Nov. 2011, Telepova 901 (holotype P).

**Taxonomic notes.** Lindley (1833) described *Doritis pulcherrima* based on a collection made by George Finlayson in 1821 from Turon (Tourane in French, now called Danang), Vietnam, brought to him by Wallich (*Wallich Catalogue No. 7348*). This taxon has more recently been transferred to the genus *Phalaenopsis*, as *P. pulcherrima*, which is regarded as a widespread species of Southeast Asia (Seidenfaden, 1992; Govaerts



*et al.* 2017) that grows in a wide range of habitats and accordingly exhibits wide morphological variation. This has led multiple authors to describe many distinct morphological forms; at present, 18 such varieties are synonymised under *P. pulcherrima* itself (Govaerts *et al.* 2017).

Recently, Telepova (2013) described *D. boubetii* and *D. pulcherrima* var. *cinnabarina* from Cambodia. However, given their overwhelming morphological overlap with the typical form (labellum attached to the base of the column foot, 3-lobed, with or without longitudinal ridges; labellum side lobes linear, rectangular or spatulate, erect; labellum mid-lobe 3-lobulate with erect, squarish or obovate side lobules and recurved, triangular, ovate or puigoneform mid-lobule; column with well developed foot and beaked rostellum; pollinia with elongated caudicle), as well the broad variation currently accepted within the species and the fact that these taxa occur within the wider distribution range of *P. pulcherrima*, they are here placed in the synonymy of *P. pulcherrima*.

**Global Distribution.** Borneo, Cambodia, China, Laos, India, Myanmar, Sumatra, Thailand and Vietnam.

**Specimens examined.** LAOS. Khammouane Province, Nakai District, Nakai Protected Area, near Houay Ma Lay Village, 25 Oct. 2014, Gale, Kumar, Fischer, Bouamanivong, Phothisath & Phoumathap HNL-KFBG 0319 (HNL), HNL-KFBG 0321 (HNL), HNL-KFBG 0330 (HNL), HNL-KFBG 0401 (HNL), HNL-KFBG 0415 (HNL), HNL-KFBG 0420 (HNL); Savannakhet Province, Phin District, Dong Phou Vieng National Protected Area, 9 Dec. 2016, Gale, Kumar, Phaxaysombath, Phothisath & Phoumathap HNL-KFBG 0888 (HNL); Champasak Province, Phatoumphone District, Xe Pian Protected Area, near Huay Phai Village, 20 May 2017, Gale, Fischer, Kumar, Bouamanivong, Phaxaysombath & Lorphengsy HNL-KFBG 1104 (HNL); Bolikhamxay Province, Pak Sam District, Ban Hang Sing, 13 Dec. 2017, Bouamanivong HNL-KFBG 1462 (HNL).

### New combinations

#### 1. *Grosourdyia vietnamica* (Aver.) Kumar & S.W.Gale, **comb. nov.**

*Theana vietnamica* Aver., *Taiwania* 57: 137 (2012). Type: Northwestern Vietnam, Hoa Binh Province, Lac Son District, Tu Do Municipality, Mon Village, 500–700 m, 25 March 2011, Averyanov, The, Vinh *et al.* CPC 1592 (holotype CPC; isotype LE).

**Taxonomic notes.** *Theana* Aver. (Averyanov 2012) was merged into *Grosourdyia* Rchb.f. by Pridgeon *et al.* (2014) based on their similar morphology and given the wide morphological diversity present in Subtribe Aeridinae as a whole; this position was followed by Chase *et al.* (2015). However, the single member of *Theana* was not transferred to *Grosourdyia* at the time.

#### 2. *Luisia sonii* (Aver.) Kumar & S.W.Gale, **comb. nov.**

*Lockia sonii* Aver., *Orchids (West Palm Beach)* 81: 364 (2012). Type: Vientam, Son La Province, Son La City, Chieng Co Municipality, 20 Dec. 2010, Averyanov, Loc, The, Vinh CPC 1140 (holotype CPC).

**Taxonomic notes.** Pridgeon *et al.* (2014) merged

the genus *Lockia* Aver. (Averyanov *et al.* 2012) into *Luisia* Gaudich., although they suggested that *Lockia* could be a natural hybrid between *Luisia* and *Vanda* R.Br. Chase *et al.* (2015) followed this stance. We concur with these two publications and hence make the required new combination here.

#### 3. *Holcoglossum gaoligongense* (G.Q.Zhang, K.Wei Liu & Z.J.Liu) Kumar & S.W.Gale, **comb. nov.**

*Pendulorchis gaoligongense* G.Q.Zhang, K.Wei Liu & Z.J.Liu, *PLoS ONE* 8: 7 (2013). Type: China, Yunnan, Gaoligongshan, Lushui, 2010 m, growing on the branch of a big tree, 10 Oct. 2011, Z.J.Liu 5871 (holotype NOCC).

**Taxonomic notes.** The genus *Pendulorchis* was originally described from China and was differentiated from *Ascocentrum* Schltr. (now included within the genus *Vanda* R.Br. (Gardiner, 2012; Gardiner *et al.* 2013)) and *Tsiorchis* Z.J.Liu, S.C.Chen & L.J.Chen (now included within the genus *Holcoglossum* Schltr. (Chase *et al.* 2015)) on the basis of the pendulous habit with a long stem, 6–10 pointed leaves, 6–5 inflorescences each with 17–39 flowers, and the unequally sized viscidium and pollinia (Zhang *et al.* 2013). Within it was placed *Pendulorchis himalaica*, newly transferred from *Ascocentrum*, and the newly described *P. gaoligongense* (the latter being designated as type).

More recently, Gardiner (2012) treated *Ascocentrum himalaicum* (Deb, Sengupta & Malick) Christenson as *Vanda himalaica* (Deb, Sengupta & Malick) L.M.Gardiner, although Xiang *et al.* (2012) found it to be nested within *Holcoglossum*. All four members of the *Pendulorchis*-*Tsiorchis*-*Chenorchis* clade of Xiang *et al.* (2012), namely *Tsiorchis kimballiana* (Rchb.f.) Z.J.Liu, S.C.Chen & L.J.Chen, *Tsiorchis wangii* (Christenson) Z.J.Liu, S.C.Chen & L.J.Chen, *Ascocentrum himalaicum* and *Chenorchis singchii* Z.J.Liu, K.W.Liu & L.J.Chen, have since been transferred to *Holcoglossum*, leaving *Pendulorchis gaoligongense* as the sole remaining member of the genus. Although it has yet to be included in a molecular phylogenetic analysis, we find no features that could justify maintaining this taxon as distinct from *Holcoglossum*—at generic level. The species is therefore here transferred to *Holcoglossum*, in effect reducing *Pendulorchis* to a taxonomic synonym of that genus.

In this context, it is worth noting here that there are a further two Epidendroid genera with similarly pointed, terete leaves, namely *Cleisostomopsis* Seidenf. and *Seidenfadeniella* C.S.Kumar. Members of these genera are also yet to be included in a phylogenetic study. At present, *Cleisostomopsis* is considered distinct on the basis of the Y-shaped callus on the back wall of its spur, whereas the spur of *Seidenfadeniella*, like *Pendulorchis*, has either simple thickening or a thickened bridge. Further analysis is required to fully evaluate the status of these two genera.





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